

DISSERTATION

How Designers Teach -

a Qualitative Research on Design Didactics

ausgeführt zum Zwecke der Erlangung des akademischen Grades eines Doktors der technischen Wissenschaften

unter der Leitung von

Ass.-Prof. Dipl.-Ing. Dr. techn. Peter Purgathofer

E187

Institut für Gestaltungs- und Wirkungsforschung

eingereicht an der Technischen Universität Wien

Fakultät für Technische Naturwissenschaften und Informatik

von

FH-Prof. Dipl.-Ing. Konrad Baumann

8630860

Rosenberggürtel 35/12

A-8010 Graz, Österreich

Wien, am

Kurzfassung

Diese Arbeit baut auf der Annahme auf dass das von Wissenschaft und Technologie übernommene methodische Erbe ein Hindernis darstellt, sobald die Arbeit eines Designers oder einer Designerin benötigt wird, d.h. in den neuen Disziplinen User Interface Design und Interaction Design oder Mensch-Computer Interaktion (HCI). Die Didaktik dieser Fächer sollte sich vielmehr an der Methodik der Designausbildung orientieren.

Aufbauend auf Mitch Kapor's (1990) Postulat dass wir eine professionelle Disziplin Softwaredesign schaffen müssen, sowie dass SoftwaredesignerInnen eher wie ArchitektInnen und nicht wie ComputerwissenschaftlerInnen unterrichtet werden sollen, war es das Ziel der Studie, designspezifische didaktische Ansätze zu finden und zu ermitteln, ob und wie diese für die Designdisziplinen im Bereich der Informations- und Telekommunikationstechnologie angewendet werden können.

Im Rahmen dieser Studie wurden Tiefeninterviews anhand eines 75 Fragen umfassenden Leitfadens mit elf Lehrenden in verschiedenen Design-Disziplinen aus Europa und den USA durchgeführt. Die Tonbandaufnahmen wurden transkribiert und größtenteils ins Englische übersetzt. Danach wurde die Textmenge am Beginn der Inhaltsanalyse mittels einer zahlenbasierten Methode sortiert.

Nach der inhaltlichen Neugruppierung wurde ein Vergleich mit Literatur über Didaktik und Designtheorie angestellt, besonders mit den Werken von Lawson (1984, 1997) „How Designers Think“ und Gedenryd (1998) „How Designers Work“. Einige bemerkenswerte Ergebnisse dieser Studie betreffen Charakteristika der Lehrmethoden im Design wie die Meisterklasse oder das Studio, die Evaluierung von Projektarbeiten in sogenannten abschliessenden Kritiksitzungen („Final Crits“), bei denen externe ExpertInnen eingebunden sind, die Methode der Projektweitergabe („Handover“), wobei eine Übungsaufgabe in Phasen unterteilt wird, an deren Ende das Artefakt jeweils an eine/n andere/n StudentIn weitergegeben wird sowie die Bedeutung von interdisziplinärer Arbeit und Studierendenaustausch.

Allgemein konnten keine spezifischen Schulen in der Designdidaktik identifiziert werden, sondern eine Vielzahl verschiedener Methoden. Die Designlehrenden kombinieren diese Methoden zu ihrem individuellen Portfolio. Ihre Individualität und die Bedeutung des persönlichen Unterrichtsstils ist der einzige gemeinsame Nenner. Die Designausbildung ist jedenfalls in einer Phase des Umbruchs, der vorwiegend durch den raschen Wechsel neuer Technologien dominiert wird.

Die Dissertation wird ergänzt durch zahlreiche Übersichtstabellen und detaillierte graphische Darstellungen der Studienresultate.

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Doctoral thesis submitted in July 2004

at Vienna Technical University

Design and Assessment of Technology Institute

(Institut für Gestaltungs- und Wirkungsforschung)

Vienna, Austria

Supervisor: Ass.-Prof. Dipl.-Ing. Dr. techn. Peter Purgathofer

Author: FH-Prof. Dipl.-Ing. Konrad Baumann

Rosenberggürtel 35/12

A-8010 Graz, Austria

Abstract

This thesis is based on the assumption that the methodical heritage acquired from science and engineering can become a stumbling block in an environment where the work of a designer is needed, i.e. in the new disciplines of user interface design and interaction design or human-computer interaction (HCI). Didactics of these disciplines should better be rooted in the methodology of design education.

So starting from Mitch Kapor's (1990) postulate that „we need to create a professional discipline of software design. (...) Software designers should be trained more like architects than like computer scientists“, the aim was to find didactical approaches specific for design education and to explore whether and how they can be used for the new design disciplines related to information and communication technology.

An interview-based study among educators in architecture and other design disciplines was carried out. In this study eleven in-depth interviews based on a guideline with seventy-five questions were carried out, recorded on tape, transcribed and if necessary translated into English. At the beginning of the content analysis the large amount of text was sorted by a number-based approach.

After clustering the information a comparison with literature on didactics and design theory was made. Related work is Lawson's (1984, 1997) „How Designers Think“ and Gedenryd's (1998) „How Designers Work“, among others. Among the highlights of this study are findings about teaching methods in design like master classes or studios, the evaluation of project work in so-called final critique sessions or „final crits“ involving external experts, training methods for design like the handover of projects, where an exercise is divided into distinct phases and the artifact is repeatedly handed from one student to another one, the important roles of interdisciplinary work and student exchange.

In general no distinct schools of design education but a large variety of different methods could be identified. Every educator combines them to his or her individual portfolio. Individualism and the importance of the educator's personal way of teaching is the only common denominator. Design education is definitely in a period of transition mainly driven by the technological changes.

The thesis is complemented by a variety of overview tables and detailed visual representations of the results of this study.

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Part II

Full versions of the interviews available on request from the author.

Interview guideline (English version)

Günter Domenig (translated)

Pelle Ehn (original version)

Andreas Gruber (translated)

Joseph Gründler (translated)

Gerhard Heufler (translated)

Urs Hirschberg (translated)

Orhan Kipcak (translated)

Rob van Kranenburg (partly translated)

Fiona Raby (original version)

Michael Szyszkowitz (translated)

John Zimmerman (original version)

Part III

Original versions of the interviews in German available on request from the author.

Interview-Leitfaden (German interview guideline)

Günter Domenig

Andreas Gruber

Joseph Gründler

Gerhard Heufler

Urs Hirschberg

Orhan Kipcak

Rob van Kranenburg (mixed in German and English)

Michael Szyszkowitz

Acknowledgements

I would like to thank the supervisor of this thesis, Peter Purgathofer, for selecting a topic of great interest and for his continuous support. Also I would like to thank the interviewees who supported this work by their time and knowledge, namely Günter Domenig, Pelle Ehn, Andreas Gruber, Joseph Gründler, Gerhard Heufler, Urs Hirschberg, Orhan Kipcak, Rob van Kranenburg, Fiona Raby, Michael Szyszkowitz, and John Zimmerman.

The first contacts in 2002 with the supervisor of this thesis, Peter Purgathofer, introduced me to the field of design research, mainly represented by the work of Bryan Lawson and Henrik Gedenryd who in turn based their findings on earlier work done by Donald Schön and Christopher Alexander, among others. Their ideas became the theoretical foundations of my work in education and most ideally complemented earlier examples I followed since my time at Philips like Donald Norman, Ben Shneiderman and Aaron Marcus. The possibility to teach in co-operation with Peter Purgathofer and other educators in our field like Martina Molnar, Keith Andrews, Gerhard Heufler and John Zimmerman also became influential for my view on education. Finally the participation in and co-organisation of workshops and conference sessions on design education have been valuable contributions to this study, namely at the BCS-HCI Education Workshop 2003 in Edinburgh, Interact 2003 Conference in Zurich, CHI 2004 Conference in Vienna. These contributions or workshops were made possible by Matthias Rauterberg, Paula Kotzé, John Zimmerman, Shelley Evenson, Peter Purgathofer, and Irene Mavrommati, among others. Financial support for my participation in these events came from my employer FH Joanneum. Input to an advanced version of this text also came from Jörg-Martin Pflüger and Margit Pohl. Explicit and implicit input for my educational practice and therefore also for this thesis came as well from several members of the Convivio network for people-centred systems and my educator colleagues at FH Joanneum in Graz, Austria, and Donau-University Krems, Austria, as well as from colleagues teaching at FH Dornbirn, Austria, and HdM Stuttgart, Germany.

Introduction

This work started from the assumption that there is a need for new teaching methods in the education and didactics of human-computer interaction (HCI), user interface design (UID) and interaction design. While traditionally these methods were derived from the disciplines of engineering and science, the author suggests that user interface and interaction designers should be trained like designers, not like engineers or social scientists. This text presents the outcome of a study that tries to map design education methodology and uses qualitative interviews as the research method.

Human-computer interaction arose as a field from the close neighbourhoods of computer science and psychology. The ACM SIGCHI (online) curriculum for human-computer interaction enlists as the roots of HCI the disciplines »computer graphics, operating systems, human factors, ergonomics, industrial engineering, cognitive psychology, and the systems part of computer science«, all of which are either engineering or socioscientific disciplines. As a consequence it is no wonder that the education of practitioners and scientists in HCI and UID is dominated by the methods of these two disciplines. Typically, HCI and UID curricula are embedded into software engineering and/or psychology programmes, as can be seen from many examples in Gary Perlman's (2004) excellent web directory of HCI education. The aforementioned ACM SIGCHI paper on curricula for human-computer interaction definitely places HCI education well within engineering: »Regardless of the definition chosen, HCI is clearly to be included as a part of computer science« (ACM, online).

In everyday professional practice many HCI professionals work as user interface designers. We have to ask ourselves whether HCI should be taught more like other design disciplines, and less like engineering or social sciences. This thesis is based on the assumption that the methodical heritage acquired from science and engineering can become a stumbling block in an environment where the work of a designer is needed. The author suggests that the methodology of HCI education should better be rooted within the context of design education. This »repotting« of HCI education would have little impact on the curriculum, where multidisciplinary and openness should already take central roles: »(...) therefore, it is advantageous to frame the problem of human-computer interaction broadly enough« (ACM, online). It would, however, necessitate fundamental changes in teaching methodology.

A similar shift from the rationalistic approach to a more suitable one for design currently takes place in the field of *design theory*. Therefore while this thesis is on the didactics of design, in many aspects it has its foundation in the recent findings and in the literature on design theory, like e.g. Lawson (1994, 1997) and Gedenryd (1998). Wood and Wood-Harper (1993) argue that the design of information technologies has been dominated by a rationalistic tradition. The reason for this influence seems to lie in the aforementioned roots of HCI education. As the two key principles in rationalistic design they cite design as functional analysis, as described by Lanzara (1983), and design as problem-solving, most prominently described by Simon (1973).

Design as functional analysis has its roots in the scientific management tradition initiated by Frederic Taylor. It is based upon the assumption that all information about design requirements is available to the designer, and that such information can easily be assimilated. Consequently, the engineer has only to analyse a problem thoroughly in order to have the solution ready at hand. Design as functional analysis assumes that design is a deductive activity.

Design as problem-solving rejects the rational model of functional analysis, and introduces the concept of "bounded reality", accepting the idea that human beings have cognitive limitations constraining the amount of information that can be absorbed and processed. Since a problem cannot be understood as a whole, it is continually reduced and simplified - bounded - until it becomes sufficiently well-defined to be resolved. Next, alternative solutions are evaluated sequentially, until one such solution fits an implicit set of criteria well enough. This solution is called satisficing, in that it satisfies a minimal, rather than optimal set of solution criteria.

Both approaches, design as functional analysis as well as design as problem solving, fail to offer ways of dealing with problems that can stand the test of daily practice. Additionally, both methods cannot encompass the discovery of new knowledge, in particular the discovery of unstated goals and evaluation criteria. Moreover, these approaches fail to take into account that the point of view from which one looks at a situation determines the problems one sees, as it is for example discussed in Bryan Lawson's »How Designers Think« (1997). The rationalistic tradition of software design is based on a rather deterministic model where the individual ideas, viewpoints, interests and feelings do not change the objective problem itself. Effective, innovative user interface design must stay severely limited in this context, and consequently this must be the case as well for an equally effective HCI education.

Still, these models are quite appealing to engineers. Engineering, in a sense, is a paradigm where a logical, analytical approach is used to tackle problems. Typically, larger problems are split up into smaller, interconnected sub-problems until the solution for each sub-problem nears triviality. Ideally, each solution can be proven to be correct. A rationalistic view of design is a "natural" complement to this paradigm. But, not only the rationalistic models of design fail when it comes to the discovery of new knowledge, they also fail to take into account that the point of view of the designer plays an important role in any design process (Lawson 1997). Most of all, in their deterministic nature, they neglect the existence of contradiction in human values. In the development of software and interactive systems in general, all aspects of a situation that deal with humans involve interests, opinions, hopes, values and morals, which are normally not only subjective but also incomplete, and very often contradictory. Since these aspects cannot be dealt with in a logical, analytical way, they get pushed aside.

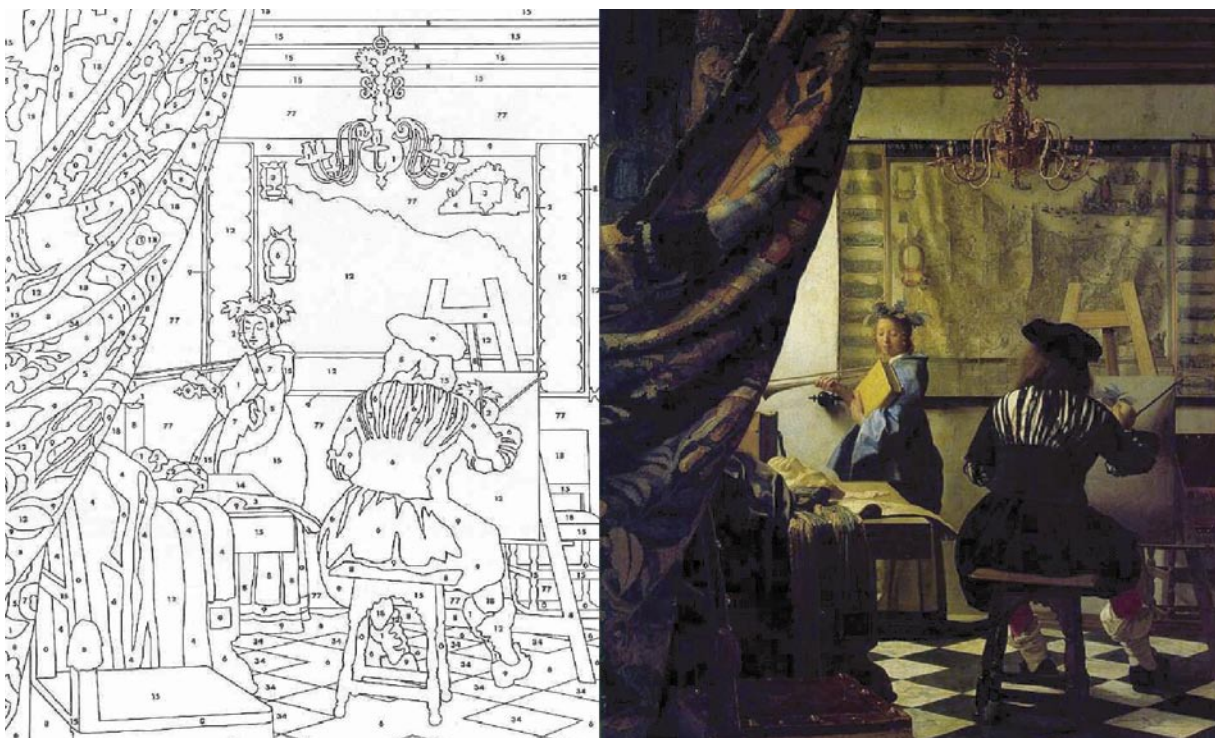


Figure 1: A metaphor for the categories of tame and wicked problems made from a Vermeer painting.

The interface between the user and a system is defined in a way as to minimally interfere with the "real" problem, which is the system to be implemented. Engineering methodology leads the benevolent hardware and software designer to a definition of the problem in such a way (using scientific

reductionism) that user involvement is not reduced to a minimum: socio-technical problems turn into goal-driven, technical problems (Gasson 1999). Using Rittel and Webber's (1973) categories of tame and wicked problems, this can be seen as the redefinition of a given situation such that a maximum of tame problems, and a minimum of wicked problems have to be tackled. It must be noted that this does not happen out of insensitivity or incapability: the marginalization of human aspects in software design is necessary for engineers to apply their knowledge and methods to as many aspects of the process as possible. This practice also explains a commonly observable phenomenon in software design: at the very end of a development project, when graphic designers are involved to give the software a "nice looking" user interface, they often face usability problems that are too severe to be resolved by a mere rearrangement of graphical elements.

Mitch Kapor (1990) wrote in his much-cited »A Software Design Manifesto«: »We need to create a professional discipline of software design. (...) Software designers should be trained more like architects than like computer scientists.«. The education of architects represents an interesting phenomenon: it is offered within a traditional scientific framework (e.g. at a university), an engineering framework (e.g. at a university of technology) as well as within an artistic framework (e.g. at an academy of applied arts). Internationally, architectural education is placed within these three contexts of science, engineering and art. So why not learn from applied arts and design education in order to advance HCI education?

Curricula are only half of what is necessary in order to educate HCI students. The other half, teaching methodology, is barely covered in these curricula. As a result, these programs often follow other study courses in respect to their teaching methods, reusing methodology from science and

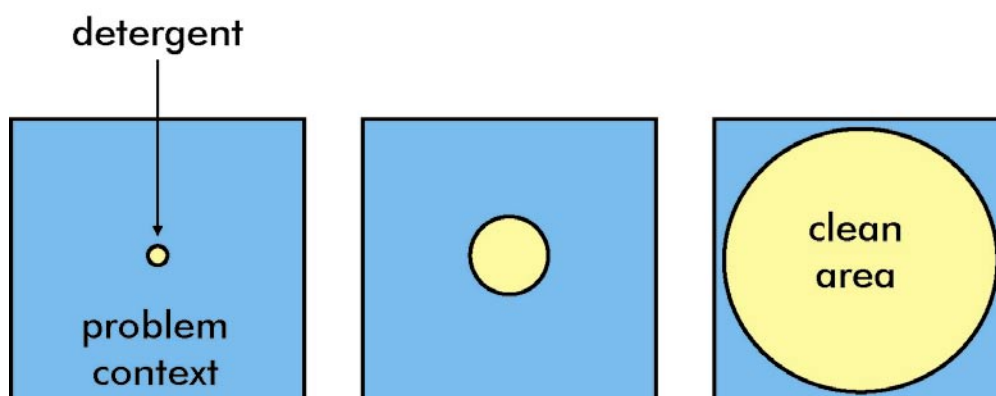


Figure 2: Another metaphor for Rittel and Webber's (1973) categories of tame and wicked problems

engineering education. The starting point of this thesis is the belief that in order to train »software designers« (in Mitch Kapor's sense) or »system designers« we should look at the teaching methods of design education. (Purgathofer & Baumann, 2003; Baumann & Purgathofer 2003)

Personal view on didactics

While several disciplines have didactics as a part of their university curricula, design and technology do not. With my background in technology and my experience as a user interface designer in industry, I never planned to teach. My first teaching experience was at Donau-University in Krems, Austria, where I started to give full-day seminars on HCI in 1999. I immediately liked teaching to the extent that in 2000 I left industry and became a full-time lecturer in interaction design and user-centred design at an only recently founded Austrian university college of information design. It is a part of the requirements of this position to give lectures or seminars up to the amount of fourteen units per week which is clearly superior to the lecturing workload usually required from „classical university staff“, and comes close to the teaching workload of high school teachers. In my position lecturing is not done like a side-job of a researcher, but it is the central activity at least during the 32 weeks of the two semesters of the Austrian academic year.

For me it was a nearly natural consequence that I became interested in design education methods and started looking for input and fruitful exchange with other practitioners and researchers in didactics, especially concerning a common base of references regarding e.g. exercises and problems for group work or evaluation and grading of students' work. I felt that in design education the findings of general university didactics were too general and could not be directly applied, while on the other hand my own education as a technologist did not provide me with any good examples of education methods either.

Since I became a lecturer in a school of information design I often faced a gap between the technical and design disciplines. It is definitely hard to find the right balance between these two worlds in an information design curriculum. HCI is considered nearly as a „soft skill“ by students of technology, who usually deal with much more intellectually complex problems, and the fact that usability deals with real users makes it fundamentally different from most aspects of a technical discipline. On the other hand HCI is more of a „hard skill“ for design students, because it has much less of the creative freedom that they are used to in their discipline.

As Lawson (1997) points out, „Design education in the form we know it today is a relatively recent phenomenon. That a designer needs formal instruction and periods of academic study and that this should be conducted in an educational institution are now commonly accepted ideas. The history of design education shows a progressive move from the workplace into the college and university studio.“ (Lawson 1997: 4)

Research method

Design is one of the „most soft skills“ par excellence which is to a large extent outside of the area of secure quantitative scientific findings based on experimentation, measurement and statistics. Therefore it became quite obvious that the only research method that would do justice to the field of design would be a qualitative one, namely the research method of in-depth guided interviews with experienced and successful educators in the various fields of design. In the recent past some authors have become prominent with research based on interviews with successful researchers or practitioners from their field of interest, like Peters and Waterman (1993) „In Search of Excellence“, Mihaly Csikszentmihalyi (1994, 1997) with his research on the phenomena of flow and creativity, and Bryan Lawson (1994, 1997) with his aforementioned books „Design in Mind“ and „How Designers Think“ that are most close to this thesis because of the topic and the research method. Therefore these books served as examples both in terms of the interview methodology and in the way of how the content has been analysed later on.

At the beginning of the project in autumn 2002 I prepared an interview guideline consisting of some seventy-five questions clustered into sixteen groups. The questions are not so much based on questions raised in the literature, but to a large extent they are the result of an analysis of the challenges my colleagues and I face in teaching design and the resulting open questions that arise. The interview guideline can be found below in this chapter. Originally the guideline was in German language, so it had to be translated. The same holds for most of the interviews.

The guideline document used for the interviews consists of the following fifteen groups of questions that are divided again into three to ten sub-questions. They also correspond roughly to the chapters of this text, while a few modifications in the order and numbering of chapters have been made during the content analysis.

- 1 General information on the interview partner
- 2 Preferred education methods
- 3 Practical-oriented teaching versus theoretical foundations
- 4 Interdisciplinarity
- 5 Teaching creative design skills
- 6 The design process
- 7 Design schools
- 8 The ideal form of design education
- 9 Grading and evaluation
- 10 Access limits to schools
- 11 Internationality and student exchange
- 12 Future trends and challenges
- 13 Reception in public
- 14 Conflicts of interest between aesthetical, usability and economical factors
- 15 Gender specific aspects of education

The number of questions in the guideline is definitely very high, and there is a considerable amount of overlap. However, this was done so on purpose because I had the feeling that in this way I would be prepared to the individual differences of the interviewees. I expected every interviewee to give emphasis to a different subset of the questions.

Unless otherwise stated all interviews have been performed during the year 2003 in the interviewees' offices in Graz, Austria. Some interviews took place at conferences I attended during this period and where I participated in or co-organised workshops on HCI and design education: the BCS-HCI Group's HCI Educators' Workshop 2003 in Edinburgh, UK; the DC Tales Conference 2003 in Santorini, Greece; and the IFIP WG 13.1 Workshop on HCI Education at Interact 2003 Conference in Zurich, Switzerland. These workshops and the discussions with the other participants were also a valuable source of input on the topics presented here.

The interviews have been recorded using a Sony (TM) Professional analogue standard-size cassette tape recorder and an external microphone. Because of the limited recording time of the cassettes there have been sentences lost in a few cases. The typical duration of a single interview was one hour. In all cases no other person besides the author and the interviewee has participated in the

interview. No written notes have been made of the interviews. The tape recording was therefore the only output that has been used for the transcription. The interviews have all been performed in one single session and only interrupted by short telephone calls in a few cases.

The selection of the interviewees has been done according to the following criteria: The interviewees needed to be experienced in teaching at a university level in a discipline related to design or architecture. I tried to select a balanced range of interviewee's ages, schools and fields of activity. Also no single mindset or belief within the field of design should be over-represented. With respect to the geographical location there is, however, some emphasis on people who currently are or formerly have been working in Graz, Austria, where the author is based. The geographical distribution, background and current position of the interviewees is shown in tables 1 and 2. The names are listed in alphabetical order.

Only after eleven in-depth interviews had been carried out using this method over a period of one year in 2003, I decided to deliberately interrupt the research phase and to start with the analysis of the content. The first step was to make transcriptions of the tape recordings. After that, as all interviews had been done in the mother tongue of the interviewee, I had to translate the interviews into English. In my opinion the German-speaking community in design education is so small that it would not have made sense to publish this study in German. However, the original transcriptions of the German interviews are available from the author on request. This thesis is a summary of the translated interviews complemented by a literature review and my own comments.

The questions and answers presented in this document are preceded by two kinds of numbers that belong to a simple ordering system I used to structure the content at the beginning of the content analysis. There is one question number (1 to 85) which corresponds to the interview guideline's numbering system. The questions' second number (1.000 to 15.000) corresponds to the number system that has been used for content analysis purpose. In this system, multiples of 1.000 correspond to the headings of question groups. Multiples of 100 correspond to single questions. In the least significant two digits, the numbers 1 to 11 correspond to the 11 interviews that have been performed. I also used the same system to insert most of the related quotations from literature (e.g. Bryan Lawson, Henrik Gedenryd) and comments by the author. This procedure done in Microsoft Excel (TM) has been used to transform the content of all interviews to the question-oriented order that forms the basis of this text.

Non-numbered questions labelled with my initials ‚KB‘ have been posed verbally during the interview. They deviate from the guideline and usually aim at elaboration of a topic. In some interviews the questions have been read loud by the author, in others the interviewee read the guidelines him- or herself. Some interviewees stuck to the single questions, others gave more general answers to the whole group of questions. This has sometimes led to questions to which no answer relates directly, but sometimes one answer would relate indirectly to more than one question. Therefore in most cases unanswered questions have not been deleted from the interview transcriptions because they show the general area of interest related to the group of questions.

The order of the question has to a large extent followed the order seen in the guideline. The questions have not been communicated to the interviewees in advance, so they gave their answers immediately after reading or hearing the respective questions. Only in a few cases the interviewees used additional material to illustrate their statements during the interview: Günter Domenig used a book on his Steinhaus (stone house) and some other publications by his office, Urs Hirschberg showed the website used for his seminars, and Michael Szyszkowitz showed some publications illustrating the output of his workshops and seminars.

While it has not been requested by any of the interviewees the transcriptions of the interviews have been sent to most of them via e-mail. Only in a few cases the interviewees later-on made some comments or minor changes to their answers. Therefore the transcriptions in this text are very close to what has been actually said during the interview sessions.

Interview guideline

In this section the complete interview guideline document is presented and explained. The interview guideline contains an extensive number of questions and it is certainly on the upper limit of how long such a guideline can be without over-stressing the patience of the interviewees. However, it was my intention not to stick to every question but to skip several of them if this seemed appropriate. I used to stay more on the surface of every topic and go into more detail if the interviewee seemed willing to elaborate.

General Information

At the beginning of the interview I tried to gather some general information on the interviewee. In some cases the interviewee referred to a curriculum vitae (c.v.) available on a website or proposed to send me some. I included only a short version of the c.v. into this text that would provide enough information to understand the specific position of the interviewee with respect to education, and the other main issues discussed here. Also this was the reason to ask for some parameters here like the number of students participating in seminars.

- 1 Name of interview partner:
- 2 At which institution do you teach?
- 3 Please give a short description of your own professional education.
- 4 Where did you get your professional education?
Where have you been living and working so far?
- 5 Which lectures or seminars do you currently teach or have you been teaching? /
Where? / When?
- 6 How many students usually attend your lectures or seminars?
- 7 Are you also active as a thesis supervisor?

Teaching by „gurus“

These two questions originally were part of the guideline section before. When I put together this interview guideline I thought that the interviewee's own education and his or her examples or teachers would go together well. Later I separated the two questions because their impact goes beyond general information - it is rather the beginning of talking about one's way of teaching.

- 8 Who are or were your personal professional examples („gurus“) in your discipline?
- 9 Do you deal with the practical work of eminent (important) professionals in your teaching?

Methods of teaching

The third group of questions is one of the most important ones. The character of the first question is definitely „very open“, so it generated a broad range of answers. When an interviewee did not mention a certain teaching method it does not mean that he or she does not use it. On the other hand, this chapter will show what are the teaching methods that the interviewees think in the first place. In some respect question number 10 is the central question of the study. The questions on group work have been planned as a separate cluster of questions which I later combined with the question on teaching methods.

- 10 What are important teaching methods in your lectures or seminars?
- 11 Is there group works in your seminars? If yes, what is the group size?
- 12 What is the value of group size for you? What is the effect of group work?
Does group work also have negative implications?
- 13 If you use group work, how do you grade it?

Theoretical vs. practical aspects

The theory-practice dichotomy seems very central to me in education. Certainly the view on this topic depends heavily on one's own education and therefore on the country where one got the own education. I expected to get controversial answers from this cluster of questions.

- 14 Do you see a conflict between theory and practical aspects of your discipline?
- 15 If yes, how do you deal with this conflict?
- 16 Does this influence your teaching?
- 17 What role do aspects of practical work play in your seminars or lectures?
- 18 What role do theoretical foundations play in your seminars or lectures?
- 19 Do you relate your teaching with your practical work, e.g. as an architect, as a civil engineer, as a consultant, or with the work of other professionals?
- 20 Do you present examples of your work in your lectures or seminars?

Interdisciplinarity

For me there is some logical order in the interview guideline. When I have talked about the ratio of theoretical and practical parts of a curriculum, the interdisciplinary aspect comes to my mind next.

21 Do you establish links to other disciplines in your lectures or seminars?

22 If yes, to which ones and by what means?

Creativity and creative design

So far the questions in this interview guideline have not been specific to design education, but they could well apply to any discipline. Now it is time to focus on some more design-specific aspects of didactics. The most important characteristic of a design discipline as it is perceived by the general public is certainly creativity. Of course creativity plays an important role in several other e.g. scientific, technical and management disciplines.

There starts to be some overlap and redundancy in the questions. I never tried to avoid such overlap, because I thought it would be better to skip a question during the interview than to miss a good opportunity for a question. In some cases I thought repeating a question could even bring additional information which turned out to be the case quite often.

23 What role does creativity of students play in your teaching?

24 Do you appreciate methods for enhancing creativity in your own work?

25 If yes, what methods do you appreciate or use?

26 Is it possible to use creativity techniques in lectures or seminars? Do you do this?

27 What is the role of „gestaltung“ (creative design) in your teaching?

28 Can creative design skills be learned or taught and if yes, to what degree?

29 If yes, what methods can be used to learn or teach design skills (principles of design, practical work, feedback from experienced designers, exercises, study of the works of others)?

30 How do you estimate the ratio of acquired skills to individual talent, especially regarding the ability to do creative design?

31 Can you name some examples of how to teach design skills very effectively and efficiently?

32 Can people better learn to design during practical work or in the context of a formal education?

The design process

The design process is a central issue in design in general. While the public is interested in the artefacts produced by designers, design theorists focus on the process of how to generate the artefacts. Therefore the believes of educators regarding the process is fundamental for their view on design education.

My own experience as a user interface and interaction designer led me to ask for test methods. I knew that testing is probably very specific to usability and expected to get very different answers to these questions.

- 33 Do you favour a certain process model for the design process? If yes, which one?
- 34 What role does such a design process play in your lectures or seminars?
- 35 Do you explicitly teach design methods? If yes, which ones?
- 36 Do you teach methods of how to evaluate or test designs? If yes, which ones?
- 37 What role do test methods play in your lectures and seminars?

Design schools

The position of an interviewee regarding the design process discussed above can be seen as related to the personal values and believes as a designer. As a consequence it is interesting to know whether the interviewees see themselves as exponents of a certain school of thought in design or whether they follow a rather individual set of values.

- 38 Are there works of design that have influenced you and your work? If yes, which ones?
- 39 Do you consider yourself as an exponent of a design school or movement (e.g. deconstructivism) or do you feel being close to one or more of them? If yes, to which ones?
- 40 If yes, is this reflected in your teaching?
- 41 Are there other design movements that are highlighted in your lectures or seminars?
- 42 Do you feel your work is influenced by current trends or fashion?
- 43 How strong is the influence of fashion and trends to your discipline in general?
- 44 If you feel there is a strong influence, how do you react on it?
- 45 Does your attitude towards trends and fashion influence your lectures or seminars?

Kinds of education

After having discussed some very design-specific issues in the last three clusters of questions, it is time for addressing the important and difficult questions. The following questions would probably not be adequate to be asked at the beginning of an interview, because answering needs careful consideration of many aspects. This is achieved by addressing those aspects first and the more difficult general questions in the second half of the interview.

- 46 What is for you the ideal kind of education or training in your discipline? Is it represented by universities, colleges, academies or other schools? Is there a difference depending on whether a student likes to become a practitioner or a researcher?
- 47 For the ideal kind of education or training, are there concrete examples of schools that represent it or come close to it?
- 48 Please explain why you made this choice.
- 49 Does the education or training you offer fundamentally differ from your own one?
- 50 If yes, what are the differences? What has become better or worse over time and why?

Grading

From my experience as an educator it was clear to me that grading can give more reasons for discussion in design than in other disciplines. Design quality is more difficult to measure than the results of students' work in e.g. medicine or technology. Grading is an inseparable characteristic of education. However, grading will only apply after educating and may be considered as less important by some educators, so the chapter on grading appears in the second half of my guideline.

- 51 How is the grading done in your lectures or seminars?
- 52 Do you think it is possible and/or does it make sense to grade and evaluate design skills?
- 53 If yes, how do you grade and evaluate design skills in your lectures or seminars?
- 54 How do you evaluate and grade master theses and/or doctoral theses?
- 55 How do you evaluate a design outside your lectures or seminars, e.g. when you are part of a jury?
- 56 Does your approach to grading differ from other common approaches?
- 57 According to what criteria do you evaluate design quality?
- 58 Do other criteria play a role in grading your students, like for example whether they actively

participated in the seminar during the whole term, whether they asked questions, whether they were visibly motivated, e.g. by the form of their contributions like drawings, mockups, computer-generated prototypes, field research, exposés.

In addition to the questions related to education I decided to add some that go beyond didactics because in my opinion the issue of objectivity in the evaluation of work is of general interest and has to be seen in a wider context.

- 59 Do you think it is possible or it would make sense to bring the evaluation of design quality to an objective level? If yes, how is this or could this be done?
- 60 In contrast to this, is it possible to objectively evaluate the quality of a design which stems from a time some decades earlier? Please explain!
- 61 What could be the criteria applicable to this task?

A thorough discussion of evaluation needs to include it the other way round, too. Therefore I concluded this big cluster of questions with the following ones:

- 62 In your lectures or seminars, have you used the method of evaluation done mutually by the students themselves? Or have you used this as a cross-check for the students with your own evaluation in order to train the students' evaluation skills?
- 63 If no, do you think methods like this could be valuable or interesting?

Access limits

Access limits are common in most schools worldwide, so they may be taken for granted. However, access limits in education have been demolished in Austria some fifty years ago, with the exception of a few study programs. The re-introduction of access limits in parallel to the foundation of Austrian polytechnics has been a matter of considerable debate. A discussion of access limits can not be separated from group size, drop-out rate and study time.

- 64 Are there access limits to your lectures or seminars or to the whole study programme?
If yes, please explain.
- 65 What do you believe is the effect of access limits?
Would it be preferable to have them or not?

International aspects

The last quarter of the interviews has been dedicated to some minorly important issues. I labelled this part with „reserve questions“ because it would not do a lot of harm to finish an interview at this point if we would run out of time. However it turned out that most interviewees answered these questions as well and even seemed to really enjoy them.

- 66 How valuable is it in your opinion to participate in a students‘ exchange or study abroad?
- 67 What is the minimum or optimum duration for studying abroad? Please explain.

Future trends

As far as affected by technology, design disciplines have been subject to increased dynamics and speed of innovation during the last few decades. A view on the future can therefore be valuable to complement this interview.

- 68 What are the most important challenges in your discipline for the coming years or decades?
- 69 What can you do as a teacher in order to prepare your students to face these challenges?
- 70 Can you name examples where this has been done successfully?

Public reception of design work, conflicts of interest

In this section I combined some more issues of general interest that have not been addressed before. I felt these were the issues that could have influence on the way of education, while they are certainly not central to it.

- 71 In your work, do you take into account the reception in the public of contemporary art, design, architecture or technology?
- 72 If yes, does it influence your lecturing?
- 73 Does the public opinion influence your own design work?

Sometimes there are arguments that describe a dichotomy between aesthetics and usability. It is argued that they are on opposite ends of a scale and can not be optimised in the same time.

- 74 Do you see a conflict between aesthetics and usability in design?
- 75 If yes, how do you meet this challenge in your own work?

76 If yes, does this influence your lecturing?

A similar set of questions is dedicated to the relationship between design and economy.

77 Do you see a conflict between design aspects and economic aspects in your work?

78 If yes, how do you meet this challenge in your own work?

79 If yes, does this influence your lecturing?

Finally a question on regional aspects concludes this chapter.

80 Do regional aspects play a role in your own work?

81 If yes, does this influence your lecturing?

By adding all these questions on issues which definitely go beyond didactics it was my aim to be able to recognise patterns or schools in design didactics, if there were any.

Gender aspects

The last cluster of questions is dedicated to gender aspects. It is clear to me that female designers are under-represented in industry, in exhibitions, and in education. In this interview study female educators are under-represented as well, but this issue would probably be worth a separate study.

82 Are there gender-specific differences concerning the talent in design?

83 Are there equal opportunities for equally skilled and talented men and women in your discipline?

84 Is this reflected in your lectures or seminars?

Material

At the end of the interview in some cases I asked for examples of educational material, e.g. exercises and problems. Some interviewees proposed to send me their c.v. or a portrait photograph. This request was sometimes added later-on via email.

85 Could you give me some examples of your seminar exercise briefings or of your students' work?

Summary of the outcomes

The outcomes of every group of questions are summarised at the beginning of every chapter in this text. Wherever possible a table or even a graphical representation is added in order to give better overview. In most of the graphical representations the following colour coding is used:



Figure 3: Colour coding used in this text

As it is the nature of a qualitative interview method, the answers are not always comparable and coherent. For this reason it was often not possible to decide whether an interviewee said „yes“ or „no“ in reply to a specific question. Instead the interviewees usually expressed a more differentiated opinion which included positive and negative aspects of the issue. This kind of answers usually are labelled in blue colour.

While the colour coding in most cases is an over-simplification of the answers, I decided to use it in order to provide a first overview on whether there was a common understanding about an issue or not. In this way it is possible to scan through the colour coding first and to read the details only if the summarised result leaves any open questions. Also I tried to cluster the answers in such a way that positive ones come first, undecided ones next and negative ones at the end.

After I had finished to translate every answer into the colour coding scheme I decided to generate an even more condensed version where all answers are summarised on one page. This graphical representation is much too information-rich to be self-explanatory. It needs careful detailed consideration and the meaning is only accessible to somebody who has already read the text of this content analysis. While I am aware of this important drawback I decided to use this representation as an add-on and to make it part of this document. Together with the colour coded representation a textual summary of the outcomes concludes the content analysis of the interviews.

General information

This chapter features with an overview on the interviewees presented in table 1. More details on the education and career of the interviewees is presented in the following section, where the answers to the questions 1 to 5 have been combined. In some cases information from an available c.v. has been used to complete the information. The questions 1 to 5 are as follows:

- 1.100 Question 1 *Name of the interviewee:*
- 1.200 Question 2 *At which institution do you teach?*
- 1.300 Question 3 *Please give a short description of your own professional education.*
- 1.400 Question 4 *Where did you get your professional education? Where have you been living and working so far?*
- 1.500 Question 5 *Which lectures or seminars do you currently teach or have you been teaching? / Where? / When?*

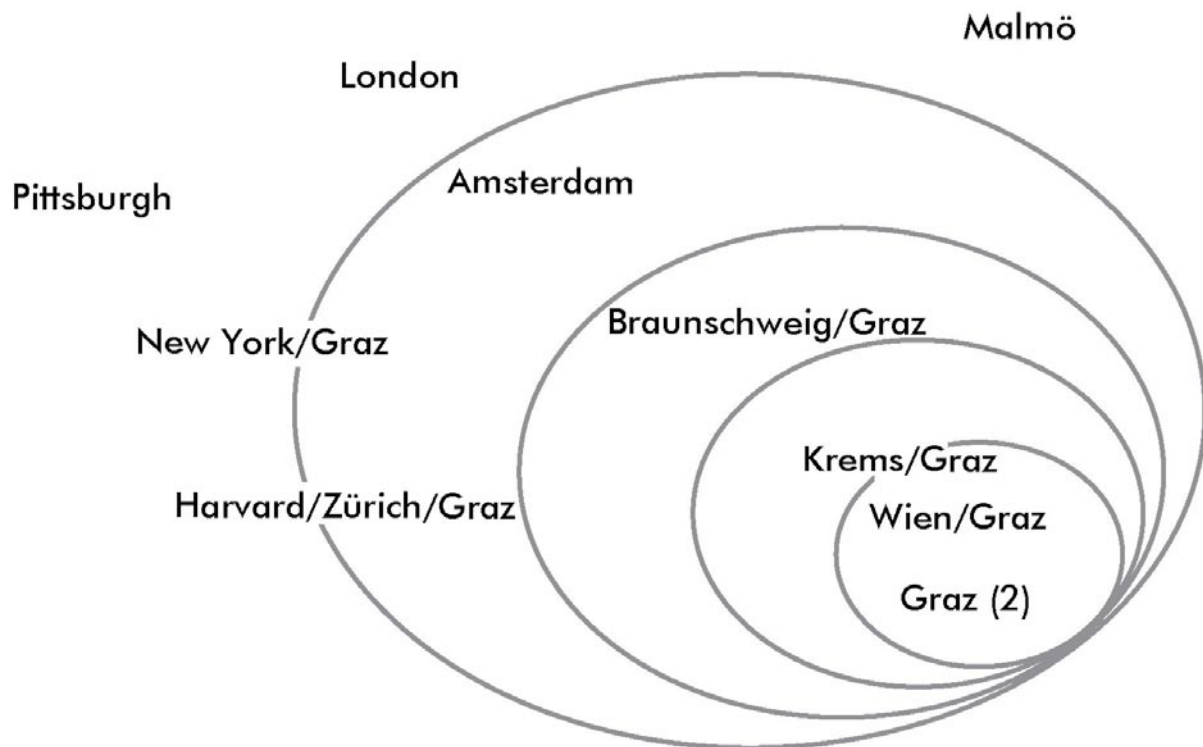


Figure 4: Geographical location of the interviewees

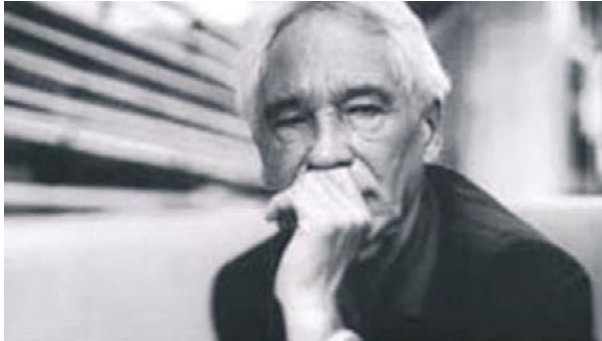


Figure 5: Günter Domenig and his "Steinhaus"

Günter Domenig

architecture

Graz Technical University

Domenig Eisenköck Peyker Architects, Graz

Günter Domenig is the doyen of a movement known as the „Graz School of Architecture“ that became prominent during the last three decades of the 20th century. He describes himself as „a child of the so-called immediate post-war generation“. After primary school and two years at a grammar school focused on ancient languages he attended a college of construction engineering (HTL, Höhere Technische Lehranstalt) at the age of 14. After studying architecture at Graz Technical University he worked in different architects' offices and then started his own office. He won several architectural competitions, built extensively in Austria and abroad and also became famous for his sculptural own house in Steindorf, Carinthia, Austria, the „stone house“. In 1980 he became a full professor of architecture at Graz Technical University and had this position for 20 years in parallel to running his office. Now he is professor emeritus and still active in building. (See also the chapter on interdisciplinarity for a more detailed description of Günter Domenig's career.) Because Günter Domenig is the most well-known exponent of the Graz School and has been active in teaching for a long time I tried to have him as a participant in this study. I am happy that he immediately agreed to give the interview.

Links: Graz Technical University, Domenig, Architektur Consult ZT Domenig Eisenköck Peyker, Steinhaus.



Figure 6: Pelle Ehn

Pelle Ehn

informatics, interaction design

Lund University

Malmö University, Sweden

Pelle Ehn studied informatics and worked as a professor in informatics at Lund University in Lund, Sweden. Now Pelle Ehn is professor at the School of Arts and Communication at Malmö University, Sweden, and one of the founders of the school and of the Interactive Institute, the associated national research institute. For the last 15 years his research has been focused on design and digital media. His books and papers in journals and international conferences on the subject include *Computers and Democracy* (1987), *Work-Oriented Design of Computer Artifacts* (1988), *Scandinavian Design - on skill and participation* (1992) and *Manifesto for a Digital Bauhaus* (1998). He is mainly supervising the PhD students in interaction design, but also giving lectures to graduate and undergraduate students. Students at the master level can have very different backgrounds, for example interaction design, graphic design, product design, set design, informatics, computer technology, or music. I met Pelle Ehn at DC Tales Conference in Santorini, Greece. During the sessions and discussions his long experience in teaching and in reflection on design theory made it obvious to me that Pelle Ehn would be a valuable interviewee. In fact he is the only participant in this study who has a background in computer science.

Links: Lund University, Malmö University, DC Tales Conference.



Figure 7: Andreas Gruber

Andreas Gruber

architecture

Cooper Union, New York

Graz Technical University

Andreas Gruber has studied architecture at Graz Technical University in Graz, Austria, and at the Cooper Union in New York, NY. After that he worked for 10 years in architects' offices in Vienna, Austria, and in Upper Austria. Now Andreas Gruber is living in Graz and working full-time as a senior lecturer in architecture at the Graz Technical University's Institute of Art and Design. Andreas Gruber teaches lectures and seminars in art and design, 3D construction, 3D modelling, 3D rendering, theory of the Internet, of information technology and of the media. I got in contact with Andreas Gruber because he is active as a guest lecturer at FH Joanneum. He not only agreed to give the first interview in the series, but he also became the first person apart of Peter Purgathofer to test and approve the interview guidelines. He stated after the interview that only because the topic and the questions were very interesting for him, he was motivated to carry out such a long interview without interruption. Also he gave me very valuable hints regarding other possible interview partners.

Links: Graz Technical University, Cooper Union, FH Joanneum.



Figure 8: Joseph Gründler

Joseph Gründler

medicine, electronic music

University Graz

Graz University of Arts

Donau-University Krems

Joseph Gründler is a well-known composer and electronic musician. He has studied classical guitar (unfinished), then studied medicine at Karl-Franzens University in Graz and made his PhD. He made autodidactical experience as a music composer and in electronics and computer programming. He co-founded the Klammer-Gründler duet active in electronic music. He is a full-time senior lecturer at Graz University of Arts, Institute of Electronic Music and Acoustics, Graz, Austria, and an external lecturer at FH Joanneum's department of Information Management and at the department of New Media of Donau-University in Krems, Austria, a private post-graduate university. He teaches lectures and seminars in sound recording technology for instrumental musicians, sound design, audio technology for electronic publishing, and digital audio technology. While I know Joseph Gründler as an important Graz-based musician I only came in contact with him because of his guest lecture at FH Joanneum. He is certainly the most interdisciplinary person among the interviewees and therefore helps this study to have a much broader scope.

Links: Karl-Franzens University Graz, Graz Technical University, University of Arts Graz, Klammer-Gründler, FH Joanneum, Donau University Krems.

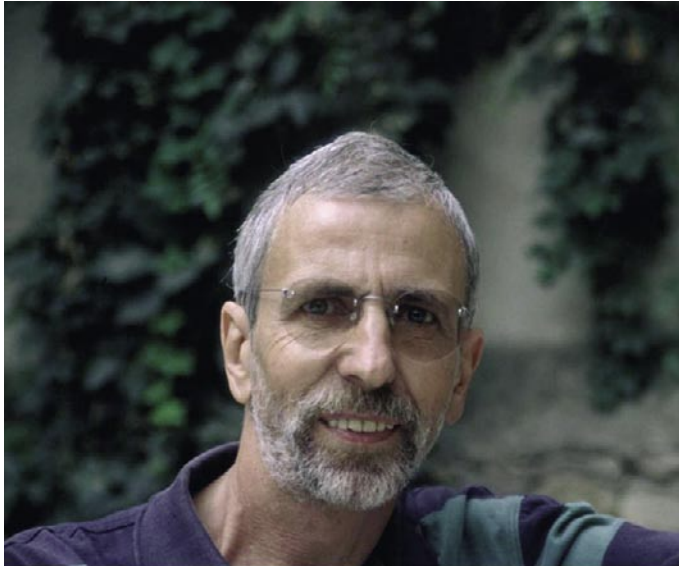


Figure 9: Gerhard Heufler

Gerhard Heufler

architecture, product design

Graz Technical University

Siemens München

FH Joanneum Graz

Heufler Design Graz

Gerhard Heufler is one of Austria's most prominent and award-winning industrial designers. He has studied architecture at Graz Technical University. After that he worked in Munich, Germany, and then in Vorarlberg, Austria, for an architectural company. Then he worked for seven years at Graz Technical University as a lecturer. Subsequent to this he had a teaching contract at the Mozarteum College of Art in Salzburg, Austria. He got into product design through his work at Siemens in Munich. Now he is working as an independent industrial designer and he is head of the Industrial Design department at FH Joanneum university college in Graz, Austria. Gerhard Heufler teaches an introduction to industrial design, design analysis or product analysis and project seminars in the 3rd and 6th semester. His lectures and seminars are in the form of integrated teaching, where theory and practical exercises are combined, and project work or project-oriented teaching. The first lecture on design I followed was the one given by Gerhard Heufler in the 1980s at Graz Technical University. I later got advice from him for my diploma thesis in the early 1990s. Since 2000 I am working at the same institution as Gerhard Heufler, the FH Joanneum, which gives me the opportunity to have regular discussions and co-operation with him and his department.

Links: Graz Technical University, Mozarteum Salzburg, Siemens, FH Joanneum, Heufler Design.



Figure 10: Urs Hirschberg

Urs Hirschberg

architecture

Harvard University

ETH Zürich

Graz Technical University

Urs Hirschberg studied architecture at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland, and worked in an architectural office after that. Back at ETH again he became increasingly involved in research projects for computers and architecture. He started his experience in education with teaching computer-aided architectural design at ETH and for three years in Harvard, USA. Now he is a professor of representation methods in architecture and new media at the department of Art and Design at Graz Technical University in Graz, Austria. Since 1995 he has been active in teaching., Since 1996 he co-ordinated the course and later was in charge as an assistant professor. From 2000 he taught „The Fundamentals of CAD“ at the Graduate School of Design in Harvard, and he later started his own courses there, these being ”Visualising Information” and ”Advanced 3D Modelling and Animation”, a course that dealt with visualisation of data and designing of dynamic interfaces. The other one dealt with animation, whereby an approach was chosen that focused less on software and much more on the art-related side. He always had seminars where the lecture parts were combined with practical exercises.

Links: [ETH Zurich Swiss Federal Institute of Technology](#), [Harvard University](#), [Graz Technical University](#).



Figure 11: Orhan Kipçak

Orhan Kipcak

architecture, media design

FH Joanneum Graz

Graz Technical University

Academy of Applied Arts Vienna

ADM Atelier of Digital Media Vienna-Graz

Orhan Kipcak is one of Austria's prominent figures in media design. He has studied architecture at Graz Technical University, and film at Vienna Film Academy. He started working with computers in the 1980s. He has been working as a designer, exhibition curator and author. Since 2001 he is professor for multimedia design at the FH Joanneum's department of Information Design in Graz, Austria. In 1992 he started teaching simulation technology and visualisation at the department of Architecture at Graz Technical University, then multimedia production at the Academy of Applied Arts in Vienna, and presently he is teaching multimedia design at FH Joanneum's department of Information Design in Graz. Orhan Kipcak runs his own business ADM Atelier of Digital Media with offices in Graz and Vienna, Austria, and has presented his work at Ars Electronica festival, among other places. He is a sought-after guest speaker at universities and art events. We are both working at the same school and frequently co-operate in planning seminars or projects.

Links: Graz Technical University, Vienna Film Academy, Vienna Academy of Applied Arts, FH Joanneum, ADM Atelier for Digital Media.



Figure 12: Rob van Kranenburg

Rob van Kranenburg

literature, performance,

theory of arts

Academy of Arts, Amsterdam

Performance Theatricality, Antwerpen

Willem de Kooning Academy, Rotterdam

Rob van Kranenburg has studied literature in Tilburg. Then he worked in online learning at Ghent University, then as a coordinator for new media at Amsterdam University. Now he is working as a lecturer in theory at the Academy of Arts in Amsterdam. In 2002 and 2003 he was mentor of the postgraduate course 'Theatricality' at Amsterdam Performance Theatricality. He is a guest lecturer at the Willem de Kooning and Saint Joost Academy, attached to the Simsim research group at the University of Ghent. He co-programmed Doors of Perception 7 Conference on the design challenge of pervasive computing. Recently he founded Resonance Design consultancy with Markus Kirsch and Alan Munro, a company focussing on future applications of RFID tags and ubiquitous computing. I met Rob van Kranenburg at DC Tales Conference in Santorini, Greece. He is the only interviewee of this study having a background in literature which adds this important aspect to the study.

Links: Tilburg University, Ghent University, Amsterdam University, Amsterdam Performance, Willem de Kooning Academy, Saint Joost Academy, Simsim Research Group, Doors of Perception Conference, Resonance Design Consultancy, DC Tales Conference.



Figure 13: Fiona Raby

Fiona Raby

architecture, media design

Royal College of Art, London

Dunne_and_Raby, London

Fiona Raby's background is in architecture. She did her undergraduate at the School of Architecture in Birmingham, then she spent a year out in private practice in Winchester. After that she spent two years at a postgraduate in the Royal College of Art, and then she spent three years working with the architect Keichi Era. She is a senior lecturer at the Royal College of Art's department of Computer-Related Design in London. Her first teaching experience was in product design, and in 1995 she started teaching in architecture at the Royal College of Art, which she has been doing since then. She also teaches in industrial design and interaction design, but only on short projects. Her main experience has been in architectural education. She runs her own practice in art and design, Dunne and Raby, together with her partner the designer Tony Dunne. I met Fiona Raby at the Convivio Network Summer School in Ivrea, Italy, at DC Tales Conference in Santorini, Greece, and at DIS Conference in London, UK, where she was a keynote speaker together with Tony Dunne. Already before the interview Dunne and Raby's work in the area of cultural probes and interventions was very interesting and inspirational for me.

Links: Birmingham University, Royal College of Art, Dunne + Raby, Convivio Network for People-Centred Systems, Interaction Design Institute Ivrea, ACM DIS Conference.



Figure 14: Michael Szyszkowitz and his partner Karla Kowalski

Michael Szyszkowitz

architecture

Graz Technical University

Braunschweig Technical University

Szyszkowitz and Kowalski Architects Graz

Michael Szyszkowitz is one of the most well-known architects of the Graz School. He has studied architecture at Graz Technical University in Graz, Austria. He received his professional experience in the Behnisch office and in the Domenig and Huth office during the preparations for the Munich 1972 Olympic games. After that he founded his own office together with Karla Kowalski. They won several competitions and built extensively in Austria and Germany and in various areas like schools, churches and housing, among others. Now Karla Kowalski has a professor's chair in Stuttgart, Germany, and Michael Szyszkowitz is head of the Institute of Architectural Design at Braunschweig Technical University's faculty of Architecture, in Braunschweig, Germany. He teaches lectures and seminars and does diploma thesis supervision, all in the field of architectural design.

Links: Graz Technical University, Behnisch + Partner Architects, Szyszkowitz + Kowalski Architects, Braunschweig University.



Figure 15: John Zimmerman

John Zimmerman

theatre, film,

interaction design

Philips Research, New York

Carnegie-Mellon University, Pittsburgh

John Zimmerman received an undergraduate degree in history followed by a background in film, video and multimedia production. Then he received a masters degree in Interaction Design from Carnegie Mellon University (CMU) in Pittsburgh, Pennsylvania, USA. He had different positions at CMU's Media Design Center and Philips Research before becoming a faculty member at CMU in 2002. John Zimmerman teaches the fundamentals of interaction design to both design students and then also computer science and behavioural science students. (See also the chapter on interdisciplinarity for a more detailed description of John Zimmerman's career.) I know John Zimmerman from the time when we both worked with Philips. We both left Philips in the mean time but stayed in contact and regularly meet at conferences like Interact in Zurich and CHI in Vienna. We co-organized a workshop at CHI 2004 on the relationship between design and HCI both with respect to research and education.

Links: John Zimmerman at CMU, Carnegie Mellon University, Philips Research, ACM CHI Conference.

	Name	Background	University / School	Location	Other activities
1	Günter Domenig	architecture	Graz Technical University / School of Architecture	Graz, Austria	founder of Domenig, Eisenköck and Peyker Architects, Inc.
2	Pelle Ehn	informatics	Malmö University / School of Arts and Communication	Malmö, Sweden	formerly professor in informatics at Lund University, Sweden
3	Andreas Gruber	architecture	Graz Technical University / School of Architecture	Graz, Austria	formerly active as an architect in Vienna and Graz, Austria
4	Joseph Gründler	medicine, music	Graz University of Art - Electronic Music; FH Joanneum - School of Information Management; Donau-University Krems - New Media	Graz, Austria / Krems, Austria	artist in electronic music, co-founder of Klammer-Gründler Duet
5	Gerhard Heufler	architecture	FH Joanneum / School of Product Design	Graz, Austria	founder of Heufler Product Design, Inc., Graz, Austria
6	Urs Hirschberg	architecture	Graz Technical University / School of Architecture	Graz, Austria / Switzerland / USA	professor at ETH Swiss Federal Institute of Technology and Harvard University, USA
7	Orhan Kipcak	architecture, film	FH Joanneum / School of Information Design	Graz, Austria	founder of ADM Atelier of Digital Media, Inc.; Lecturer at Vienna University of Applied Art and at Graz University of Technology
8	Rob van Kranenburg	literature	Antwerp Theatre School / Theatricality Performance; Willem de Kooning Academy, Rotterdam	Antwerp / Rotterdam, The Netherlands	co-founder of Resonance Design, Inc. with M. Kirsch and A. Munro
9	Fiona Raby	architecture	Royal College of Art / Computer-Related Design	London, UK	co-founder of Dunne and Raby, Inc., art and design office, London, UK
10	Michael Szyzkowitz	architecture	Braunschweig University / School of Architecture	Braunschweig, Germany	co-founder of Szyzkowitz and Kowalski Architects, Inc.
11	John Zimmerman	drama, film	Carnegie-Mellon University / School of Computer Science	Pittsburgh, PA, USA	formerly interaction designer with Philips Design, Inc., in Briarcliff, NY, USA

Table 1: Information on the interviewees, overview (Note: FH is an abbreviation for „Fachhochschule“ and can be translated by polytechnic school or university of applied science.)

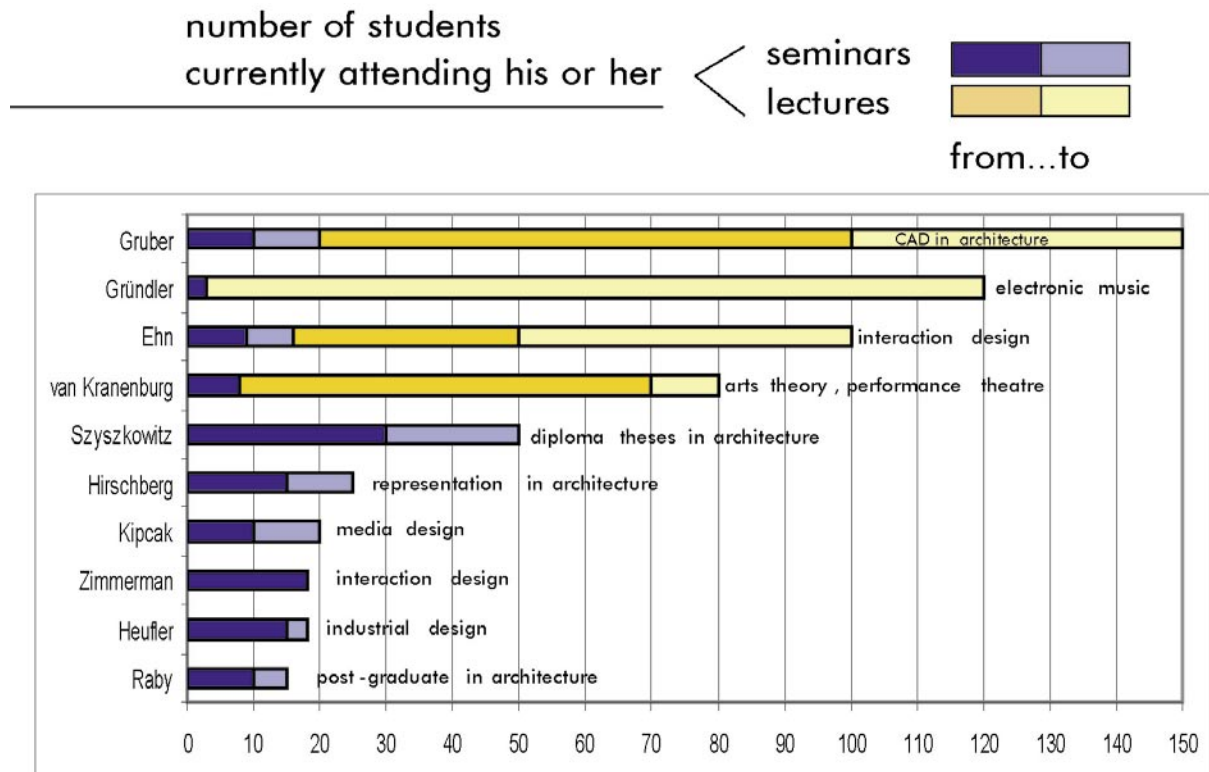


Table 2: Number of students attending the seminars or lectures (blue: minimum and maximum in seminars; yellow: minimum and maximum in lectures)

1.600 Question 6 How many students usually attend your lectures or seminars?

As table 2 shows the interviewees are teaching design seminars for between three and fifty students with a typical value of fifteen. Design lectures are taught for up to 150 students. The figures can be used for orientation only. They cannot be compared or generalised because the most important factor that determines the number of students in a seminar or lecture is the type of school. In table 2 no distinction is made based on the type of school applicable for the individual teacher, or whether he or she teaches on undergraduate or graduate level or in a PhD course. Some teachers are active in more than one type of school. Also there has been no figure stated by Günter Domenig, while later in his interview he stated that it was the increasing number of students that made it impossible for him to keep the quality of his education. Compare answer number 9.106. Also compare with the chapter on access limits, question number 11.000. All seminars listed here that have less than fifty students in a seminar do have access limits, while all lectures listed here with more than fifty attendees take place in schools without access limits.

9.106 *Domenig* I cannot name the ideal school, but I can say what does not work. I have been active as a full professor at Graz Technical University for twenty years. After that I quit this position for the following reasons: When I started to teach we had 1080 students and 48 teachers (professors and lecturers). When I left we had 2500 students and 50 teachers - a ratio of one teacher to fifty students. In this situation you cannot educate the students individually, you lose the personal contact. More than this, I did not have time to work any more (...).

The answers are listed in decreasing order of the number of students, i.e. starting with the four educators who also give lectures with many participants. All educators also give seminars in parallel.

1.601 *Gruber* Seminars in groups of 10 to 20 students, lectures for 100 to 150 students.

1.608 *Gründler* Between three and 120.

While Gruber and Gründer give neutral statements regarding the size of their lectures, Ehn and van Kranenburg definitely prefer to give seminars in small groups, like we can conclude from their following statements.

1.604 *Ehn* At our school there are 600 students, in the undergraduate level in the interaction design class there are 40 a year, 16 a year at master level, and 9 PhD students in interaction design. I work mostly with the PhD students. Unfortunately when I teach in the undergraduate level there are 50, 60, or 100 students usually. Most of the time these will be lectures. For masters and PhD students I am typically a supervisor for their projects.

1.603 *Kranenburg* In my theory lecture in Rotterdam there are 70 to 80 students. At the Antwerp postgraduate it is a wonderful situation - there are only eight students, from all over Europe - from Slovenia to Spain, there are dramaturgians, choreographers, dancers, and I am the mentor for the whole postgraduate programme.

As we can see, van Kranenburg also likes interdisciplinarity and student exchange, two topics that will be discussed later in separate chapters.

The following six educators do not give big lectures, a situation which seems to be typical for the majority of design schools for graduate students. Hirschberg and Zimmerman have teaching experience from the USA and allow us to compare national differences.

1.611 *Szyszkowitz* Between 30 and 50 graduate students.

1.607 *Hirschberg* It was always an optional subject with a lot of students, mostly over 100, from which many of them developed the pedagogic approach that was followed there. For the practical work there were groups of approx. 20 people, whereby in the very big courses I united these in the lecture situation, that all of them were also in the lecture. In Harvard there we had also smaller courses, where between 15 and 25 people attended altogether. Now it is the same here (at Graz Technical University).

1.602 *Kipcak* Between 10 and 20.

1.610 *Zimmerman* I have roughly eighteen students in a class. And I teach one class each semester, so two classes a year. The class meets twice a week for two hours, the student commitment to the class is about twelve hours of work a week including class time. Generally students take four to five classes so they are working between 50 to 80 hours (a week) so it's a big commitment.

1.609 *Heufler* Between 15 and 18 students.

1.605 *Raby* I am responsible for between ten and fifteen students. At the moment I have got twelve students I am responsible for, but when we do workshops, we come with more.

It can be concluded that the optimum and most frequently used type of design education is a *seminar with between ten and twenty students* attending, sometimes but not necessarily complemented by lectures with 50 to 150 students attending. Of course all teachers like smaller groups.

1.700 *Question 7* *Are you also active as a thesis supervisor? (Diploma or PhD)*

There are three interviewees who do not supervise theses, the rest of them does. There is no statement recorded by Rob van Kranenburg. While Günter Domenig did not state this explicitly in the interview, he definitely supervised diploma thesis, either personally or via the intermediate of his teaching staff.

The following three interviewees currently are not supervising theses, while they would like to:

1.701 *Gruber* No, because our institute is not allowed to do so. We can only be secondary supervisors.

1.708 *Gründler* Currently not.




	yes	no	undef
	7	 3	 1

Table 3: Overview of activity as a thesis supervisor.

1.705 *Raby* I would like to, but as I do not have an academic position at the moment, I don't do that.

The following five interviewees are currently supervising theses:

1.604 *Ehn* (...) For masters and PhD students I am typically a supervisor for their projects.

1.707 *Hirschberg* Yes, dissertations and theses. I am involved in the supervision here (in Graz) as well as in Harvard.

1.709 *Heufler* I supervise master theses. About six per year on average. No doctoral theses.

1.702 *Kipcak* Yes I am.

1.710 *Zimmerman* Currently I'm supervising masters students working on their masters theses, and I'm working on getting PhD students, but I've not had that experience yet.

1.711 *Szyszkowitz* Yes. It is a lot of work but it is the most exciting job to teach design, mainly when supervising theses.

In case of Domenig, Raby, Kipcak and Zimmerman we can see a frequent phenomenon in the field of design where a PhD has only been established more recently than in other disciplines. So it often happens that design teachers are appointed an academic position because of their success and competence, while they have not received a PhD. So a student may have a PhD tutor who does not have a PhD him- or herself. This is definitely not a problem with respect to their students who value the competence and experience of their tutors regardless of their degree. Also it is not a problem in the field of design where people do not ask for academic degrees, but the acceptance by art critics and the public is more important. However, lacking a PhD may cause difficulties in situations where academic colleagues from other fields are involved, like the procedure of application for tenure or for a position as department head or dean. This conflict apparently is generated by the different mindsets and value systems of the different fields.

Teaching by „gurus“

When asked for their examples or „gurus“ all interviewees but one stated at least one name up to a maximum of six names of other designers or architects who had or have a big influence on their work or thinking. In line with what Lawson says it can be concluded that *design teachers base their work on the work of others*.

„Design education has recently emerged from a period of treating history as deserving academic study but making little connection with the present. Modernism tended to be interpreted by some as the end of history. Thankfully those notions have been largely rejected and the design student of today is expected not only to appreciate historical work in its own right but to use it to inform contemporary design.“ (Lawson 1997: 5)

On the other hand Lawson also mentions a possible drawback of using previous design work in education.

„In particular an issue is the extent to which we should make design students aware of previous design work. Should students be encouraged to express themselves in a free way or to pay attention to real-world problems? Many studies have demonstrated the mechanising effect of experience which may block our mind for novel solutions.“ (Lawson 1997: 159)

In the next question the interviewees have been asked whether they used in their lectures or seminars what they considered as the examples for their own way of designing.

do design teachers base their work on earlier work?

	Number of individual "gurus" or examples	Uses examples of others in teaching
Domenig	● ● 2 names	<input checked="" type="checkbox"/> yes (guest lecturers)
Ehn	● 1 name	(no answer)
Gruber	● ● ● ● ● ● 6 names	<input checked="" type="checkbox"/> no
Gründler	● 1 name	<input checked="" type="checkbox"/> no
Heufler	● 1 name	<input checked="" type="checkbox"/> 1 name
Hirschberg	● ● ● ● 3 names + 1 institution	<input checked="" type="checkbox"/> no / <input checked="" type="checkbox"/> yes but too many
Kipcak	● 1 group (region)	<input checked="" type="checkbox"/> 1 name + 1 field <input checked="" type="checkbox"/>
van Kranenburg	● ● 2 names	<input checked="" type="checkbox"/> 1 name
Raby	● 1 name	<input checked="" type="checkbox"/> yes / general answer
Szyszkowitz	● ● no names / many influences	<input checked="" type="checkbox"/> yes, always
Zimmerman	● ● 2 names	<input checked="" type="checkbox"/> no / or 1 name <input checked="" type="checkbox"/>

work used as examples in teaching

John Haller, Peter Eisenman, Hans Kupelwieser, Walter Pichler, Raimund Abraham, Günter Domenig. / Scandinavian architects and designers, Peter Weibel. / Antonio Gramsci, Paulo Freire, Ronald Sudat. / Donald Schön. / Keiichi Irie. / Heiner Göbbels. / Antonio Gaudi, Rudolf Steiner, Anthroposophy. / Prof. Schmidt ETH, Herzog+De Meuron, MIT Media Lab. / Richard Sapper. / Egyptian and Greek architecture. / Shelley Evenson, David Kelly, Lauralee Alben, Alben + Farris.

2.100 *Question 8* *Who are or were your personal professional examples („gurus“) in your discipline?*

The detailed answers to this questions include the individuals who have been named are listed below.

2.101 *Gruber* John Haller, Peter Eisenman, Hans Kupelwieser, Walter Pichler, Raimund Abraham, Günter Domenig.

The individuals named by Gruber are all influential contemporary architects or artists either living or working in the USA or in Austria.

2.102 *Kipcak* Scandinavian architects and designers.

2.103 *Kranenburg* Antonio Gramsci, Paulo Freire.

„Perhaps the most influential thinker about education in the late twentieth century, Paulo Freire has been particularly popular with informal educators with his emphasis on dialogue and his concern for the oppressed.“ (Infed, online)

Antonio Gramsci has been an italian revolutionary thinker of the early twentieth century.

2.108 *Gründler* Heiner Göbbels, a contemporary German composer.

2.109 *Heufler* If there is a professional example in industrial design then it is Richard Sapper.

The following interviewees also give some of the reasons for choosing certain individuals as examples.

2.104 *Ehn* I had the pleasure of meeting and working with Donald Schön, his way of not only writing about educating the reflective practitioner but also his way of doing it, which is a truly inspired way of doing design education, this was really a „Vorbild“ (an example) for me for how to teach in design education, so it is both doing things, and as a teacher working as a critical coach, helping debrief what has come out both in conversation with the material and within a design group.

2.105 *Raby* My experience is in an atelier system by learning through somebody's experience. My biggest, most inspirational teacher was a Japanese architect called Keichi Era whom I learned a hell of a lot from. He was the first architect who introduced me into technology, in Japan. It is his fault that I am in this mess now (laughs).

2.106 *Domenig* I have never considered any people as examples for my work. I always tried to avoid these historical figures and to find my own personal way. But I appreciated certain styles and architects, for example Antonio Gaudí. In my early building, the Zentralsparkasse bank in Favoritenstrasse, Vienna, people who analysed it have seen two factors of influence: the Anthroposophic movement and Gaudí. The concrete elements have parallels to Anthroposophy, Rudolf Steiner and his Goetheanum, and have a plasticity like in Gaudí's work.

2.107 *Hirschberg* Professor Schmidt, who I worked with in Zurich was definitely a specialist, a great example, and still is today, and he was also my personal promoter. There are many in this area, it would take too long to list those who are important. In architecture I am a fan of the Swiss Modern, here I would choose Herzog and De Meuron, although this does not have much relevance to my present responsibilities. So Computer Art and what is going on in the Media Lab are very important. I also have a lot of personal contact with these people.

2.110 *Zimmerman* I would say people that have influenced me, certainly from the design side: Shelley Evenson, who is at Fitch in Columbus and founded her own consultancy Seespace. She did the initial interaction work on the Xerox Copiers. Her approach to using fieldwork in design, I wish I could do work at that level, I would love it. Her ability to develop design languages. Another influence would definitely be David Kelly at Ideo, a sort of mix of the academic and real product development, his ability to get different disciplines to work together to produce incredibly creative solutions. So I would say that those are my main influences, not that there aren't lots of others.

Finally Michael Szyszkowitz states that the range of influences is so big that he does not give any specific names at all.

2.111 *Szyszkowitz* This is a good but difficult question. There are so many of them that I can never stop answering. They start in Egyptian and Greek history and go up to the present. In every era there are many examples to watch, to learn from and to teach. It is not possible to give an exhaustive answer here.

So again it can be concluded that definitely designers and design teachers base their work on the earlier work on others. It can be assumed that this finding has some impact on design didactics and so we expect to get some more insight on the consequences from the next question.

2.200 *Question 9* *Do you deal with the practical work of eminent (important) professionals in your teaching?*

Most of the interviewees gave a positive or somehow differentiated answer to this question.

2.205 *Raby* Yes of course, very much, very based on the contemporary thinking now. We are always thinking of what the latest thinking is. We are keeping in touch with what thinking is at this moment, see what is happening in this moment. So in many ways we are not very historical, we work in a contemporary manner.

2.211 *Szyszkowitz* Yes, I always draw parallels to the work of others when I am teaching.

2.209 *Heufler* Richard Sapper, again.

2.202 *Kipcak* Exponents of media art and concepts, especially Peter Weibel with whom I cooperated for ten years.

2.203 *Kranenburg* Yes I published with my professor in Ghent, Ronald Sudat, on „cultural studies and language education“ and „cultural studies and e-learning“.

Like can be seen from the different statement numbers Urs Hirschberg expressed somehow different statements at two moments of the interview. These results from the interviews but also some statements from literature suggest that there is no final consensus so far on whether it makes sense to give the work of others a prominent role in design didactics.

2.207 *Hirschberg* We naturally use software, but who developed them... *KB: In the classical architecture degree course one discusses important building designers and their practical work. - (Hirschberg:) This is not the teaching approach I use... - KB: I saw a Jakob-Nielsen book outside, I would use him as an example when teaching usability. - (Hirschberg:) There is very much to say about what one teaches, what one suggests to the students. The list would be far too long.*

6.607 *Hirschberg* Of course I show the works of others in the lectures, whereby I seldom show something to be the only direction, but make the use of good work from students and show what is good and what is not so good.

Also John Zimmerman has a differentiated view of this issue.

2.210 *Zimmerman* Strangely, no. Well, I do use an example of Lauralee Alben, formerly of

Alben and Farris, some work she did for the Monterey Bay Aquarium, because she shows a nice process of user-centred design, and both on an individual level and a group level and how that mixes with the institutional needs, so the balance of user needs and institutional needs of the development of a product.

Finally Gruber and Gründler prefer not to use the work of others in teaching, while they do have individuals they consider examples for their own work.

2.208 *Gründler* Not a lot, because my lectures and seminars have a strong theoretical focus. But yes, there are some practical works.

2.201 *Gruber* No I don't do this in my seminars. This is done only in art history lectures.

The answers to this second question, however, are not at all that unanimous as the previous ones. They show the complete spectrum between yes (3 answers) and no (2 answers) with 4 answers in between yes and no. It can be concluded that there is no common understanding on whether it makes sense to use the work of important individuals („gurus“) in design education, but it is probably worth considering examples of the work of others as a contribution to design education. So while there is a consensus on design being rooted in earlier work, there is no consensus on whether design education should be rooted in earlier design work.

It should be added that in some cases, e.g. like reported in his interview by Andreas Gruber, the nature and content of the lectures and seminars does not necessitate or allow the use of examples of earlier design work. This leads us to the next question which aims at a more general investigation in the issue of design didactics.



Figure 16: Rudolf Steiner (1861 - 1925)
Erstes Goetheanum in Dornach, Schweiz, 1913 (Silvester 1922 abgebrannt)
TUM Lehrstuhl für Raumkunst und Lichtgestaltung



Figure 17: Günter Domenig: Zentralsparkasse, Wien



Figure 18: Günter Domenig: Steinhaus, Ossiach



Figure 19: Günter Domenig: t-mobile headquarters, Vienna 2003

Design education methods

This chapter presents views on the methods based on related work of design education from literature by Bryan Lawson and Henrik Gedenryd, also based on lots of statements I collected in the interviews, and complemented by a case study on studio education by Fiona Raby and a case study on problem-based learning by myself.

Lawson makes a point for learning by doing as one of the most important factors in design education.

„As we have seen (...) we learn about design problems largely by trying to solve them. Thus it may take quite a lot of effort before a designer is really aware just how difficult a problem is. (...) Design students seem to be incorrigibly optimistic in their estimation of the difficulty of problems and the time needed to arrive at acceptable solutions. As a result students often fail to get down to the level of detail required of them by their tutors.“ (Lawson 1997: 53)

Lawson states that, although there can be seen a hierarchy of design disciplines in terms of size of the design objects, there is no hierarchy in terms of the difficulty of problems. This leads him to the question where the beginning and the end of a design problem is.

„There is no way of deciding beyond doubt when a design problem has been solved. Designers simply stop designing either when they run out of time or when, in their judgement, it is not worth pursuing the matter further. In design, rather like art, one of the skills is in knowing when to stop.“ (Lawson 1997: 52)

One of the essential characteristics of design problems then is that they are often not apparent but must be found. Lawson shows that even design problems are often questioned by designers and re-scaled either by „escalation“ or „regression“ of the problem. He illustrates this with a story by Eberhard (1970) where the problem to design a doorknob ultimately leads to questioning the political system - this is called escalation. On the other hand he reports of a student who instead of designing a library focused on the methods of loaning and storing books, - this is called regression. Escalation and regression often go together. They are encouraged by design process models. Questioning, broadening or narrowing the problem can make sense to a certain extent.

„Design action, like medicine, is only needed when the current situation is in some way unsatisfactory, but which is better, to treat the symptoms or to look for the cause?“ (Lawson 1997: 55)

Design is often used to repair problems caused by earlier designs which is called a design fix. According to (Lawson 1997), again it is important here to define what we can put into question: By fixing a symptom a design fix can often even make more secure the cause of the symptom, like noise barriers to screen motorways can weaken the case for a quieter method of transport.

Design problems are often both multi-dimensional and highly interactive. Very rarely does any part of a designed thing serve only one purpose. As reported by Lawson (1997: 56) the American architect Philip Johnson is reported to have observed that some people find chairs beautiful to look at because they are comfortable to sit in, while others find chairs comfortable to sit in because they are beautiful to look at.

In design it is frequently necessary to devise an integrated solution to a whole cluster of requirements. The design of a single element like a window in a building bears problems related to many disciplines of science ranging from physics to psychology. Science offers a whole range of tools for evaluation of a design solution, while these tools give no help at all with the synthesis of a solution. (Lawson 1997: 58)

Professors in building science propose that designers should adopt a strategy that includes collecting a variety of sub-solutions. This science-like approach, however, fails to take into account the highly interactive nature of design problems.

„(...) good design is usually an integrated response to a whole series of issues. If there was one single characteristic which could be used to identify good designers it is the ability to integrate and combine.“ (Lawson 1997: 59)

To do this a designer must understand the „pattern“ or the „structure of the problem“.

„Good design depends upon the designer's ability to act according to this structure and not to run arbitrarily counter to it.“ (Chermayeff and Alexander, 1963)

These findings on the design process based on the work by Alexander (e.g. 1963) and Schön (e.g. 1983), among others, are widely accepted among design theorists. The impact that this view on the design process has on design education is illustrated in the following case study.

A classic example of problem setting used repeatedly by Donald Schön (e.g. 1983) and also reported by Gedenryd (1998, pp. 81-88). Schön describes a dialogue between an architectural student, Petra, reviewing her work with her project supervisor. The student Petra acts as a realist treating the problem as if it were given. She misses the signals that indicate an inappropriate ‚framing‘ (or ‚setting‘) of the problem which causes her to get stuck. The supervisor acts as a pragmatist. He recognises the condition of being stuck and therefore switches from solving to ‚setting‘ the problem which he applies as an instrument to serve its purpose. He proposes to ‚change‘ the problem into a different one, a strategy known as ‚reframing‘ or ‚problem setting‘. This also makes a contribution to his understanding of the situation. Then he immediately starts to work out the implications of the new problem-setting that he has suggested. By this, he does not perform an explicit but only an implicit test by working on a possible solution within the new setting. He develops a chain of solution possibilities which by the absence of failure shows that the setting is viable. This example shows that any action within the process of inquiry works as both ‚use‘ and ‚test‘ at the same time. They are not separate components of inquiry but effects of the same single activity.

„From the use angle, the act of drawing serves to develop a solution.“ (Gedenryd 1998: 85)

From the test point of view, drawing is an evaluation of the problem-setting. After all, the supervisor’s job is not to produce the solution for the student but to get her on the way again. Thereby his drawing primarily serves as a test for his suggested remedy. This example shows the tight coupling between test and use.

„The more general version of this argument is that all knowing must be tested by being put to use.“ (Gedenryd 1998: 86)

A failed implicit test will not show any signal of failure but it will simply not let the designer move forward.

Like stated by Lawson (1997: 81) often students follow ill-conceived ideas. Also students often make the mistake of evaluating self-imposed but inappropriate constraints Lawson (1997: 70).

Gedenryd (1998, pp. 90-93) points out that cognition seen as inquiry also brings a better understanding of the expert-novice dichotomy. Laboratory studies on problem solving, however, are not relevant as they can’t reflect expert performance under realistic conditions. This is in line with Lawson (1997) who states that after having tried to research design cognition by laboratory studies

he switched to the method of qualitative or in-depth interviews which is more appropriate as a research method.

In Schön's example the student „fails to recognise the need for making her problem-setting useful. Instead, problem-setting is a process where the problem is evaluated and modified if necessary, so as to adapt it to its purpose.“ (Gedenryd 1998)

At this point it is interesting to compare whether the current believes of design theorists are already widely reflected in the believes of design educators.

3.100 Question 10 What are important teaching methods in your lectures or seminars?

As a start of the main section of the interview guideline, this is probably the broadest question of the whole interview. Consequently the range of answers is very broad.

An overview on the statements given by the interviewees is presented in the following table:

one-to-one tutoring ●●●	bidirectional exchange ●●
"scholae", walk and talk ●	exchange betw. students ●●
individual email threads ●	final critique sessions ●●●●
teacher personality ●●	hearings ●
group teaching ●	competition or pitch ●
coaching of teams ●	readings and discussion ●
problem-based learning ●	action-production-reflection ●
studio-based teaching ●●●	project hand-over ●●●
workshops, group work ●●●	presentation hand-over ●
practical exercises ●●●●	excursions ●
project work ●●	guest speakers ●●
interdisciplinary projects ●●	lectures (only as part) ●●●●●

Table 6: Important design education methods as mentioned by the interviewees in the first place. Some of the table entries stem from the answers to different questions than 3.100.

From the answers to this question a big spectrum of design education methods can be seen. When I carried out the series of interviews I noted that in every one of the eleven interviews - even in the

last one I did so far - new methods and opinions arose that had not been mentioned before. So it became difficult for me to end or interrupt the series of interviews and to start with a phase of analysis and reflection. It is quite likely that additional interviews would bring even more new results or at least additional individual views on the topic.

The detailed answers to the question on design education methods are enlisted below starting with some short and general statements.

3.201 Gruber There is a lot of group work.

3.108 Gründler There are both frontal lectures and seminars with group work or workshops.

3.109 Heufler Mainly working on a project, that is definitely the main emphasis. This means practising with the use of examples, and the experience that is collected from each example can then be transferred and implemented in new tasks. Moving away from the classical didactic teaching towards compact theoretical blocks that are discussed thoroughly with the use of practical examples (often actual examples).

The last four statements already contain most of the important approaches that co-exist in design didactics. The essence these four statements applies to all interviewees, while they are not specific and do not really allow to split into different directions or schools of thought. In the following there are some more detailed and specific statements. Pelle Ehn represents a didactical approach rooted the northern European tradition of thought which is also reflected in the teaching style.

3.104 Ehn In general we believe quite strongly in the notion of *problem-based learning*. But that is very open I think. Our special, what we've found very important in design education besides the notion of coaching teams and problem-based learning, starting with real problems, is we focus on studio-based format for the teaching. The interaction design students all work either in the master class studios for master students, or in research studios for PhD students. The studios are well-equipped spaces or places both for production and reflections, but it is not entirely a cell for reading and reflection, and it is not entirely for production, but it is a space which is reconfigurable for doing both, a space for action, production and reflection. And that is a very important part of the ideology of how we try to teach. And this is both for the PhD students and for the master level students.

Later-on in this chapter I will present a case study in problem-based learning which stems from my own teaching experience. In the following Günter Domenig and Orhan Kipcak clearly demonstrate that they appear to a similar school of thought. This can be explained by the fact that Domenig has influenced a generation of architects as a professor at Graz Technical University.

3.106 Domenig I did seminars at the university, and I was forced to do lectures about architectural design. But lectures are not what we should do. There are even some earlier scientists who say that lectures do not make sense at all, they are artificial. *We can only teach architecture by doing some work*, really doing this translation process. In this sense I do my lectures where I mainly try to give the students some appetite for architecture, and some information as well. I provide an overview on the styles and movements that exist worldwide, not only historic movements but also intellectual movements, zeitgeist movements. During all the decades *I always invited guest speakers*, international architects and people from theory. Frank Gehry visited me three times. Zaha Hadid had a two weeks seminar here. So the students get an overview on what happens worldwide and how other important people work.

3.102 Kipcak The method is practical exercises in seminars. The topics are as broad as possible. I am dealing with the students individually on a one-to-one basis. I always try to invite guests who cover the whole spectrum of media design which is a broad discipline.

Some different points are made by Urs Hirschberg whose approach represents elements of the Swiss and American didactical traditions since he worked at ETH Zurich and Harvard University.

3.107 Hirschberg An integrated co-operation is very important to me. Because of the fact that with the whole section of new media one can build on to the previous various knowledge of the students; and they bring, depending (on what they have done before), a great deal of their own knowledge. I think it is very important that they exchange their knowledge between themselves. I have tried (to encourage) the students to *learn from one another and together*, so that they get the best possible basic conditions. We tried to support this principle in the mid 90's especially with the World Wide Web. We have created such integrated learning conditions, through which the whole teaching is supported.

Some more aspects of American university didactics are added by John Zimmerman from Carnegie-Mellon University.

3.110 *Zimmerman* I generally use a *studio format* for my class at the Human Computer Interaction Institute at Carnegie Mellon. It's quite mixed so there's some traditional seminar classes which are readings and discussions, there's lecture format classes, particularly the programming classes are taught in a lecture style. There are project classes and then there's a few studio classes which are design focused. What makes them studio classes is generally students do work in class, there are lots of individual meetings between faculty and students and the students review and critique each other's work as well as a public critique from the professor.

3.110 *Zimmerman* Design education generally follows two methods which is a seminar, which is readings and discussion, so there's small classes where students can really discuss issues, and studio classes where they make things and use the crit (critique) model of evaluating students' work publicly. The idea behind the crit model is that students don't need to encounter every mistake and every good solution but they learn a lot from looking at and analysing the work of others.

Michael Szyszkowitz places the teacher personality as the central element of the didactical approach. The same point is made later-on by Orhan Kipcak who slightly ironically declares himself as the teaching method.

3.111 *Szyszkowitz* This is a very controversial issue. The method is simply to introduce the person or personality of oneself, the teacher, and to convey what you believe to have understood about the world.

After that he describes his way of planning and tutoring town planning exercises in a realistic setting. At the end of his interview he gave me some of the project documentation booklets that summarise some of the described projects.

3.111 *Szyszkowitz* When supervising theses, I define a topic and the students work like for a competition or pitch. Everybody can compare the different approaches during the work, and the results at the end. Usually the topic is a city where the students have not been before, e.g. Venice, Krakow, Prague, Amsterdam or Strasbourg. There is a *fictional design exercise* which we have carefully prepared, e.g. to design a school, a library, a city hall or a museum. The requirements are based on real circumstances, e.g. the history, the environment, which makes the task realistic. In a real work situation you always have several constraints you have to take into account. So, first we make an excursion to the city. Then the students have three months to do their design work on their own.

Two weeks after the project start there is a hearing where the students can ask questions, so every student has the same level of information. So the situation is similar to a design competition. However, there are no prizes awarded, but we give ordinary grades. We don't call it „defense“ of their theses, like this is often called, but „presentation“, because the teacher is not an aggressor.

Finally Rob van Kranenburg makes a point for *individual tutoring*. If we use the terminology coming from e-learning and virtual agents, this is certainly the most adaptive teaching method. He also makes an interesting statement on society and cultural change.

3.103 Kranenburg The important teaching methods are discussion and dialogue in a one-to-one situation. I am moving away from giving a show in front of a classroom situation, the maximum is 25 to 30 minutes. My art students in Rotterdam are from a new generation who are not even used to sitting at a table for eating, so they are not used to sitting and listening to a teacher.

A lot of related statements by Rob van Kranenburg have been given later-on in his interview. They have been moved here because they fit best to this question.

8.503 Kranenburg In the arts academy's teachings there is no didactics, there is no pedagogy, it is hopeless, it is awful. Following the basic Bauhaus principles there are still people doing workshops and other people doing theory in a complete dichotomy, which is awful. So I am really happy with my postgraduate programme with people from a wide variety of disciplines. The only thing I really do is to take everyone out for a walk. I go around for a walk and talk. You should not sit and talk, because all the energy has to go somewhere.

8.503 Kranenburg And I email with them a lot. I only do individual threads, as there is no point in mailing to twenty people, nobody would really care. So I use individual two-way communication, which needs an enormous amount of time, but it gives me good evaluations of my courses. Students claim that I email them much more than I actually do, and the reason for that is because I reply to every single email they send me. People email me two or three times and they claim to have mailed me seven times, because this was their perception, because I replied to every email. Everybody likes to have feedback, either by email, phone, SMS or have a cup of coffee together - it is all about attention, no matter in which media. I have written a paper on stupid blackboard courses that people call learning. The problem in arts education is that either you have the real masters people look up to, or you have an open source model where everybody gives input. Both models do not work any more, so you have to try out a lot.

Later-on in his interview van Kranenburg elaborates again on his idea of one-to-one tutoring which is rooted in ancient times as he points out.

9.103 Kranenburg As I said, the ideal type of teaching/learning situation is the one of two people going out for a walk and talk. The thing is at the moment, when you go to schools, and you go into Philosophy departments, it's all about Platon and Aristoteles, they all talk about philosophers who are already dead for around three thousand years. But Platon and Aristoteles did not talk about philosophers who were already dead for three thousand years, but they took you out for a walk and talked about (reality). And so some are saying that at some point along the line, things were going wrong, things mugged up. The ideal form of teaching is „scholae“. There was the old greek word „scholae“, that means leisure. And we turn this into schools, which is completely crazy of course.

In the following three paragraphs Rob van Kranenburg describes one of his teaching methods in detail. It is a vision of the method of *project handover*, a principle used as well by Andreas Gruber and others.

9.203 Kranenburg My mentoring day in Antwerp is Friday, so every Friday we meet and have a cup of coffee, and then I go with every one for a walk. Every walk takes an hour or so, half an hour, three quarters of an hour. We walk around the park. There are eight people, so it takes a day. (laughs) We do this every week. Sometimes the individual walk only takes half an hour, and then we have a group discussion. Either we have a performer coming in and doing things, or we do a small task like the task that I described. It is a procedure used by Carsten Komp, an architect who is interested in empty spaces, e.g. in waiting spaces. He really used one of my simple tasks which was about synesthesia. I just gave everyone five words, and then they make a story out of it. I thought, if you have a really visual tendency, you would choose visual adjectives to these words to have feedback in a visual range. If you are a haptic person and want to touch and feel things, then you would choose haptic adjectives to these words.

9.203 Kranenburg So it can be interesting to have just five words and you are putting in five visual adjectives, that would pretty much mean that you are a visual person. Then everyone has to give their story to someone else. We can all be original of course, but from the 19th century onwards there has been this terror or cult of originality, as if it had been the most important thing you should be. So they have to give their words to someone else who has to make a poem out of it. In the third week, people really like to make poems and spend an enormous amount of work on it

because it is from their neighbours. They really get to know each other. And the third step is that they make a scene out of it from themselves, like in a play, a dramatic scene.

9.203 Kranenburg They all get the same five words, they make a story, they read their story next week, and the story is about synesthesia. Then they find the words and the adjectives, and we analyse whether people have a tendency to use visual or haptic adjectives or so. Then I swap the story, and they will make a poem out of it. The next week they will read the poem, and the other week, you get your own story plus a poem somebody else made, and then you make a scene out of your original story and the poem. So you have your own perspective and the other one's perspective, and then you make a dramatic scene out of it, which means including dialogue. Every time, there is feedback and analysis.

It is interesting to see that similar didactical approaches, like the *project handover* described above, can be applied to text design as well as to graphic design and architectural design. I will come back on handover techniques in a context of 3D design later in this study as they have been described by Gruber and Raby.

As we can conclude from the statements given by the interviewees there is probably not such a high degree of difference in the beliefs of the design educators. Instead since this have been answers to an open question there may be some more degree of overlap than the table above might suggest. Some of the statements that are likely to summarise the beliefs of most participants are:

- ✓ *One-to-one tutoring* is done in every design school at some point during the education (at least at the diploma thesis, but also earlier).
- ✓ *Studio-based teaching* is probably widely considered a good teaching method. It can be done only when the tutor-to-student ratio is high enough.
- ✓ *Lectures* are a necessary add-on to provide information and to generate awareness and appetite for different aspects of the discipline. They cannot stand alone, however, but must be complemented by practical exercises.
- ✓ Different forms of practical *exercises and feedback* are central to design education.

An interesting cross-check has been possible with the issue of group work discussed below in the next section. Only two interviewees mentioned group work as an important teaching method in

the question before. However, when asked specifically about group work most of the interviewees declared to use it (see below). It can be estimated that a similar result could be seen if the interviewees would be asked about their opinion to any of the other methods listed in the table above.

So we can conclude that:

- ✓ There is a *big pool* of design education methods. Some of them are listed in table 6.
- ✓ The methods have a certain amount of *overlap*, e.g. workshops and PBL, or hearings and crits. Some methods are elements of other methods and concepts.
- ✓ There is not a big influence of „*trends*“ or „*schools*“ in design education.
- ✓ Instead, every design teacher seems to pick his or her *favourites* out of the large pool of methods, modify some or invent some new ones and combine them to a new individual portfolio of methods which in addition is probably updated and modified constantly throughout the years.

After this general question on design methods I focused on the related and more specific issue of group work.

3.200 Question 11 *Is there group work in your seminars? If yes, what is the group size?*

After the different answers given to the last question related to teaching methodology, it is interesting to see that there is also the complete spectrum of answers available for the question related to group work. Obviously this small number of interviewees cannot be considered representative for the design educators working worldwide. But when seeing the spectrum of answers summarised below the conclusion could be drawn that every education method can make sense and can be justified from a certain point of view and under certain circumstances.

Group work is usually appreciated by the interviewees. The group size mentioned as ideal is very widespread, however.

3.202 *Kipcak* Yes there is group work, and there are usually two to three people, sometimes four people per group.

1 (individual)	Dom, Raby, Heu
2 to 3	Kip, Hir, Heu, Zim
3 to 4	Gru
4 to 5	Kra
4 to 8	Ehn
20 to 50 / more	Ehn, Hir, Szy
other	Grü , Szy

Table 7: Group size preferred by the interviewees

3.207 *Hirschberg* (...) Sometimes we let the students work in groups of two or three on a project. (...)

3.210 *Zimmerman* Yes, we definitely do group work in class. Generally I use groups of three to four students, never more than four students so that everybody can get their hands very dirty.

3.201 *Gruber* Yes there is a lot of group work. The ideal group size is three to four. We tried with eight to ten but this failed.

3.203 *Kranenburg* Yes there is. Group size is four to five students.

3.208 *Gründler* Group work is very important for me. First it is not clear to the students why they have to learn the theory. But during practical work they will face problems which need theory to be resolved. This is easier to achieve by group work.

In contrast to that *individual* work seems to be more important than group work for the interviewees Domenig, Heufler, and Raby.

3.206 *Domenig* There is both group work and individual work, it depends on the subject.

3.209 *Heufler* There is group work in the training. Groups of up to three students, whereby the individual work counts for a greater part. (See also 3.309.)

It is interesting to see that Fiona Raby reports of a failure in their education concept. Given the number of different educational approaches and the high degree of change and variability, it is quite obvious that not every trial can be a success. Like in design itself, real innovation in design education can be made by trial and error and by the continuous work on problem setting and problem solving.

3.205 Raby *Group work is very important.* And architecture students are not used to do this - they come and see their tutor and then go away. We have time for everyone to see everyone's work. It is like this in the whole research phase. Everyone needs to bring their experiments in, for example a photography experiment, and they build on each other's work. Sometimes they also do work together. Actually we made a film. It was an experiment, and it was not very successful, because architecture students are not (film directors); we should have looked at drawing actually, but never mind, we always do experiments. So they did a film and they worked together on that. And what was really nice, because we get this group mentality, because we are in a situation where there is not much time, we are a team. We are working just together, it is not just the students coming in and we, the tutors, give them a little opinion. Their projects are our projects as well and we get incredibly involved with them. So the tutors and the students, we are a team. Obviously, we are directing it, but they are bringing stuff in and they are also directing it, so it is a real mixture work.

3.205 Raby Usually they are doing their *projects as individuals*, but in our course we have got a group of three. The rest of them has chosen to work as individuals, but the year before there were groups. But in any case they are heavily influenced by each other's projects.

In some cases the same term of group work is used for different things actually. While e.g. Pelle Ehn refers to group work as saving the tutor's time, so the tutor only needs to explain or critique things once for a group and not for every individual student, Fiona Raby on the other hand uses the term group work for a group critique session or a group contact time. In Raby's case this is one day per week with two tutors and twelve students which is obviously not a time-saving ratio. In this time they could well use tutoring on an individual basis. However, Raby and other interviewees seem to see a value in group sessions in itself because students can learn from the other students' projects and the tutors' feedback to all projects.

Finally, Pelle Ehn, Urs Hirschberg, and Michael Szyszkowitz report of the largest groups used of the participants of this study, while there are differences in the details and setup of their approaches.

3.204 *Ehn* At our school, the School of Arts and Communication at Malmö University, *all work is group-based*. This is partly because we come out of a tradition of team-based work. But also you could say it may be a positive consequence of limited resources. We cannot teach design on undergraduate and master level on an individual basis. We only have resources to do it on a team-based or group-based level, which has actually been an advantage I think. Ideologically we also want to get away from the one-master-one-apprentice relation or model. Though, we want to keep some of the schemes of the one-master-one-apprentice relation in terms of that kind of critique, in showing and doing things that can be critiqued. We want to keep the critique but now more on the group level. There are many different group sizes depending on the projects. The typical normal group size is from four to eight. Especially on an undergraduate level there can also be 20 to 50 students in a group, for example when they have to simulate a production process in a company. They have to subdivide themselves to work on different tasks in that case. Normally never less than two, typically six to eight.

3.207 *Hirschberg* If you want to see this as group work – the people are able to exchange or interchange all their data. This is naturally a form of group work. In addition to this, we have also always encouraged and tried to support different forms of group work. - *KB: In which group size?* - (*Hirschberg:*) As stated the whole class of up to 120, 150 people can be seen as a group, because they are able to freely exchange their data. Additionally (there are) also groups; the class size at any one time is a (smaller) group. Then we always made smaller groups as well. Sometimes we let the students work in groups of two or three on a project. It would take too long now to list all the different things I have tried; in any case it seems to be something very important to me.

3.211 *Szyszkowitz* Yes, group work is an important element of my teaching, because architectural design cannot be made on your own. An architect's work depends on co-operation with many people surrounding him or her, e.g. people with different computer-related skills. In my design seminars the group size starts with 35 people and decreases down to smaller groups or even individual work if a student wants to do this.

3.300 *Question 12* *What is the value of group work for you? What is the effect of group work? Does group work also have negative implications?*

The detailed answers are as follows. A precondition for successful group work is stated by van Kranenburg.

3.303 Kranenburg The effect is positive when it is an authentic task where you will get a result in a direct way. (...)

Another precondition is mentioned by Domenig who makes a point for individual work.

3.306 Domenig Before starting with doing group work in a seminar, every student has to do some work on his/her own. This enables the teacher/tutor to know every student's strengths and weaknesses. I only do group work with students whom I already know. First every student has to show what he/she can achieve. Only after that I do group work, this depends on the size of the projects.

The reason why Domenig wants to know the individual profile of the students is mentioned by many other interviewees as well, like Gruber, Gründler, Kipcak, Heufler, and Zimmerman.

3.308 Gründler Usually students are not good at working on their own. The only negative aspect of group work is to hide the individual contribution.

3.301 Gruber Group work is of highest importance in my discipline, i.e. in IT-related seminars. The problem with group work is that some students do not contribute an equal part, or one works for all. It is also difficult for the students to deal with the group dynamics. Architecture students often are not used to work in groups. A benefit of group work is that the tasks can be distributed amongst the members according to their skills and interests. Other benefits are mutual inspiration and mutual motivation.

Most interviewees both see positive as well as negative consequences of group work in design education.

3.302 Kipcak A negative effect is when one or two people do most of the work and the others do not participate. A positive effect is that the whole work can be structured in different design tasks and technical tasks. Like this large projects like a CD ROM production can be implemented.

A similar view is given by Gerhard Heufler who elaborates it in more detail.

positive aspects of group work		
<input checked="" type="checkbox"/>	tasks can be distributed according to skills and interests	Gru, Kip, Ehn
<input checked="" type="checkbox"/>	increases social competence and empathy, prepares for industry, builds trust, reduces ego	Heu, Zim, Szy
<input checked="" type="checkbox"/>	creates synergy effect	Heu
<input checked="" type="checkbox"/>	mutual inspiration and motivation	Gru
<input checked="" type="checkbox"/>	students can be introduced more easily to things they don't like, e.g. programming	Hir
<input checked="" type="checkbox"/>	in-depth presentations are possible (limited classroom time)	Zim
<input checked="" type="checkbox"/>	students learn from giving/listening to presentations in (larger) group and from discussion (improvement of content, opinion, didactical concept)	Szy
problems with group work		
<input checked="" type="checkbox"/>	part of group can hide certain weaknesses or do less work than the others, people can be carried by others	Kip, Grü, Heu, Zim
<input checked="" type="checkbox"/>	evaluation and grading is difficult	Hir, Heu
<input checked="" type="checkbox"/>	students need to deal with group dynamics, architecture students not used to group work	Gru
<input checked="" type="checkbox"/>	finding a balance between using available individual skills and learning new skills	Ehn
<input checked="" type="checkbox"/>	mutual hindrance	Heu
<input checked="" type="checkbox"/>	different opinions within a group	Szy
preconditions for successful group work		
<input checked="" type="checkbox"/>	task needs to be authentic	Kra
<input checked="" type="checkbox"/>	it is good if people are already trained as children to work in groups	Ehn
<input checked="" type="checkbox"/>	tutor has to know the individual student's strengths and weaknesses before	Dom

Table 8: Benefits, problems and preconditions associated to group work

3.309 *Heufler* In this respect group work is didactically very important, because it trains one's ability to work in groups and it increases social competence. What is sometimes difficult when the students work in groups, is that we naturally have to judge the performance of the individual with respect to study progress. The effect of group work is generally, if the group functions well, a real synergy effect. There are naturally cases, on exception, where there is mutual hindrance. This also happens. - Of course there are also problems with people being carried by others. We have also worked with groups of five. In these cases two people often hide behind the others and that was a great problem. Groups of two have the greatest efficiency, but also groups of three, when the division of work seems to make sense.

It is interesting to hear from Pelle Ehn that group work issues seem to be something like an unsolved problem for the teaching staff at his school.

3.304 *Ehn* That is a good question. We have been going back and forth on this not really finding a solution. For instance, on the master level the students come in with very different backgrounds: They could have an interaction design background, a computer science background, an informatics background, a set design background, a product design background etcetera. Then there is some tension, because on the one hand you come in and you want to learn something new, you want to learn interaction design, and on the other hand you have some skills, e.g. as a graphic designer, so the group can benefit from these individual skills. To strike the balance between if the individual should get better on what he or she already is, or if the team should do its optimal performance, that is a tricky balance. On the bachelor or undergraduate level every student should be able to do everything. On the master and PhD level, however, we are more thinking that the two years on the master level, it is a way to be introduced and get into interaction design, you become an interaction designer but leaning very heavily on the education you had before, so with a strong focus on the background you have, e.g. as a product designer. But this is an unsolved dilemma.

The statement above is interesting as well in the context of the question on interdisciplinarity which will be discussed later in this study. Now, Pelle Ehn elaborates on the issue of cultural and local differences that affect didactics.

3.304 *Ehn* In general, group work is part of the Swedish tradition: Already from kindergarten on kids are trained to work in groups. For instance in the project we are running now, the atelier product we can see that, in comparing architecture students in Vienna with interaction

design students in Malmö, there's a very much stronger feeling and competence for working in groups in Malmö, much more than it is the case in Vienna. It's definitely a benefit in terms of the quality of the outcomes.

Like Pelle Ehn also Urs Hirschberg emphasises that the view on group work is directly affected by the properties of national and educational culture.

3.307 Hirschberg In my opinion group work is very valuable due to the reasons already stated. Let us take programming as an example, it is something that architects do not really like to do. Then I let them programme in pairs, it seemed a good thing and it went down well with the students, that every student can look at the other's work. - The negative effects are that the evaluation of the student's performance is difficult. If the teacher does not follow this closely it can sometimes be difficult to give fair grades. Whereas at the ETH this was not an issue, one either got a course attendance certificate or not. There grading was not an issue. Here (in Austria) and also at Harvard it is different, that is why there was sometimes a problem with it there.

While teaching a group of eighteen is considered as a small class in some countries, John Zimmerman reports of it as a „large class“, while he seems to be aware of this not being a universal point of view.

3.310 Zimmerman Somewhat group work is a requirement of - we actually call that - a „large class“ of eighteen. Group work has a couple of benefits: One is that with a class of eighteen students, there is no way that eighteen students could do (individual) in-depth presentations of their work, it would eat up all of class time. The other is that when students go into industry generally every project they work on is a group project, so exposing them to a group project teaches them to design without ego where they really need to work with and trust other people and build the designs together.

When asked for the drawbacks of group work he presents details similar to what other interviewees reported already.

3.310 Zimmerman Yes, clearly there are negative effects of group work. As the faculty member you are often put in the position of dealing with dysfunctional groups and somehow it's your responsibility to make the students work together or make a student in a group who might not be pulling their own weight do something or make students that become intransigent - stuck on their

own idea - to change their model. It's very difficult to teach groups because when you are evaluating and trying to give grades you need to realise that the actions of each individual student can detrimentally affect the grades of everyone participating in that group. Well, I had the experience of a student who was a black hole of need in every group he participated in. He was constantly dragging the grades down of everyone nearby and you need to adjust for that. But you know, students get a limited amount of class time, of taking my class and the group dynamics can definitely change that, but this student was a problem in all of the classes he took.

Like John Zimmerman also Michael Szyszkowitz describes group work as most similar to a real-life situation.

3.311 Szyszkowitz Group work is important, as I said before. There are hardly any negative effects, but you face some problems if there are different opinions within a group. It is important to learn how to co-operate. In real work situations, an architect has to co-operate with the customer and with the subcontractors. He or she has to learn empathy. Also, students learn from presentations in the group. They all analyse a topic, e.g. a public library, and present their findings in front of the group of 30 students. This is much better than to read a book about it at home. They are also more motivated and focused. They have to present pictures or a videotape on an important library building and verbally present their analysis of this building. They understand better because they have to present and explain it. They will face critical questions by the audience, so they have to define their opinion even better. Also they have to prepare their own didactical concept. So they will understand better the presentations of the other students and their concepts. There is 30 times a friction between different opinions in a group. I as a teacher, I could never do 30 presentations with so much detail as it is done by the 30 students. By the way, I also learn a lot from all these different views.

Michael Szyszkowitz also gives some details on the evaluation of group work which will be dealt with in the section below.

3.311 Szyszkowitz At the end I also give feedback to the presenters. A presentation is better than a written paper, because it is always related to the person of the presenter. It would be good to videotape it and play it back to the presenter, but I do not have time to do this. During the term there are several correction and feedback sessions by my lecturers, and two sessions with me: the first one after concept creation where I „release“ the concept, and the second one before final rendering where I give hints on what may be missing in the concept.

In this context it is interesting to compare with an argument against co-operation or team work by Gedenryd (1998: 92) who reports of a study by Nardi et al. (1991). In this study an accountant is described who learned to develop computer spreadsheet models himself because he found it impossible to make his requirements transparent to a programmer. He explained that it was easier to develop it himself than to explain it because that way he was learning about all the variables he needed.

„It seemed paradoxical, but in the beginning he appeared to have a clearer picture of the solution he wanted than of the problem. Also he described his work as ‚a prop for himself. He couldn’t make use of a programmer because it would require that problem setting could be separated from solving; not only between different phases, but between different people, even. It would have required that stage models worked as intended‘.“ (Nardi et al. reported by Gedenryd 1998: 93)

We can compare this position to the ironic, but certainly not completely false argument often claimed by software engineers saying that if you have two programmers working on a task it takes twice as long as it takes for one programmer alone to do the same task. The essence of this reasoning is that the effort needed for communication between two or more people is usually higher than expected and can wipe out the benefit of working in a team. Gedenryd, on the other hand, draws a conclusion interesting for the theory of the design process.

„In the study we found that spreadsheet users are very aware of the fact that their initial problem formulations are likely to be fuzzy, incomplete and badly structured. They like spreadsheet software because it helps them to work through these difficulties.“ (Nardi et al., 1991; Gedenryd 1998: 93)

In this context Gedenryd also compares with Lawson (1997) who reported on designers learning simultaneously about problems and solutions.

In another example Nardi & Zamer (1993: 14) reported on an accountant who prepares spreadsheets for an executive. Every time the executive would see what the accountant has prepared in anticipation, he would require something different. In fact by seeing the model, the executive could better describe what he wanted (Gedenryd 1998: 94).

Like already mentioned by Szyskowitz the challenges of group work in design education include the question on how to evaluate and grade group work and how to give additional feedback to the students.

3.400 Question 13 If you use group work, how do you grade it?

We have seen from the answers to the last question that the problem of grading group work is identified by more than one interviewee. In the following we can see that there are different approaches of dealing with this problem.

<input checked="" type="checkbox"/>	self-evaluation of group members	Kra
<input checked="" type="checkbox"/>	mutual anonymous evaluation of group members within group	Zim
<input checked="" type="checkbox"/>	individual feedback	Ehn, Hir, Zim
<input checked="" type="checkbox"/>	criteria: design quality, research, thinking, artefact, craft, rendering, presentation	Zim
<input checked="" type="checkbox"/>	mixture between individual and group grading	Gru
<input checked="" type="checkbox"/>	mutual evaluation of student groups	Kra
<input checked="" type="checkbox"/>	verbal feedback	Ehn
<input checked="" type="checkbox"/>	all group members get same grade	Gru, Kip, Grü, Heu
<input checked="" type="checkbox"/>	grading is not important, all group members usually get the best grade	Dom

Table 9: Ways of grading group work.

The simplest way of grading group work is giving the *same grade* to all members of a group. This method is used by four of the interviewees.

3.408 *Gründler* The whole group will get the same grade.

3.402 *Kipcak* There is one grade for per group. All group members get the same grade. If a very ambitious project fails I sometimes give a good grade as well, because if the concept is good but it never works technically, I value this kind of „genial failure“.

3.409 *Heufler* Group performance is also assessed by group work. Everyone gets the same, differentiations are not made. However when we notice the performance of the group is running at differing levels we talk to the group and indicate that it is unfair when one group member hides behind the others.

3.401 *Gruber* All group members get the same grade. Sometimes there is a mixture between individual grading and group grading.

On the other hand, the necessity of *individual grading* of students within a group is explained by the interviewees Ehn, Hirschberg, and Zimmerman.

3.404 *Ehn* It is also a good question. Ideologically we started that we would not do an individual grading at all. But as it is now at the undergraduate level, I cannot say how the scheme is at the moment, but we always give individual feedback, not only group feedback. So every student has a meeting with the tutor once or twice per semester where they get individual feedback on their own work. - The individual student all over the semester will have meetings where the teacher will talk about his or her work. It is very interesting that the students have been asking for individual assessment and we did not have that idea. Also in group work some students get upset by the fact that there are students who do not contribute very well, but we say it is a problem for the individuals who are not contributing very well. But there is this tension.

3.407 *Hirschberg* Perhaps I could say something about group performance beforehand. What is special about this integrated learning environment that one can also look at work in the Internet is that we are actually able to keep track of the contribution of every individual in a database. In this respect everything is accurately classified. Sometimes we let a group appear as an individual within the database, then it is a little different. But on principle we have pushed very hard to maintain the evaluation of individual contributions. Otherwise this would not be possible in such a large group.

3.410 *Zimmerman* No they don't all get the same grade. I generally grade on three things: the quality of the design, which is their design research, their thinking and final artefact. The craft, how well is it made once they have an idea, how well is it rendered, is there attention to detail, did they turn in a CD with a nice cover that harmonises with their concept, so is it a complete package that I'm given. And then in their presentation how well do they communicate their ideas. So those are the three aspects of the grade.

John Zimmerman also raises the issue of *mutual evaluation* of students which will be discussed in more detail later-on in the chapter on evaluation.

3.410 *Zimmerman* But in addition I have the students all grade each other's performance and I use that in shading the individual grades of the students. Since I mix the students in different groups for each project they can't all work in the same group throughout the whole course. So that

method gives me a way of finding out who didn't participate, and at the end of a course I mean I have the subjective ability of raising and lowering a grade even though it may not be quantifiably the grade the student has achieved, although I am almost never lower. I might raise a grade of somebody getting punished for having to work with poor people throughout the course.

3.410 *Zimmerman* Students send me the grades on their team mates via email. They only grade their team mates, and they grade them on that project they work on with them. It is secret, I mean they can share if they want, they can have their own plans, I don't need to know, but it's email, and it's verbal. Some students send me a quantitative value, some don't. I basically just use it as additional input. I don't give it a specific (weight); I should just say, for me also grading is subjective - certainly in design, but I think in any field - grading is subjective, life is subjective. So my value as a faculty member is to look at all of these inputs and subjectively come up with a grade that I feel - very much feel - a student has earned. And I'm fortunate to be at an institution that backs that up. We take a student's academic record very seriously. We really - this might be much more a U.S. model - but we actually have parents that come in and complain when their children get low grades, threaten to sue the university. We consider this as part of our ethics to give a grade and stand by it and not be influenced to changing it, so trying to make a very good decision the first time.

Finally the statements by Domenig and van Kranenburg show that for them grading is not really an important issue and they would probably rather get rid of grading if this was possible. (Note: The best grade in Austria is 1 on a scale of 1 to 5.)

3.406 *Domenig* Grading was *never important* for me. It is not interesting for me. Usually I give the same grade to all students, sometimes the best grade to all of them.

3.403 *Kranenburg* I ask the students what grade they think they deserve. They usually know their correct grade. Grades are on a one to ten scale. All groups give feedback in a plenary session and the average will be taken as the result. My own feedback is contained in the whole process implicitly. I have given feedback every week, so it is contained in the result.

Case studies on problem-based and studio-based education

This section concludes the chapter on general design didactics by presenting some detailed case studies. It starts with an overview on the context of the author's own teaching experience. After that a case study by Fiona Raby is presented. The findings are compared with case studies from literature.

My previous experience with education has been made in seminars in human-computer interaction (HCI) and user interface design (UID). During my time as a product manager for user interface design in industry I became a guest lecturer at Donau University in Krems, Austria, which is a post-graduate university offering part-time education for people aged 25 and above. I still do these seminars for adults working in different professions.

Later I became a full-time teacher at the department of information design at the polytechnic (Fachhochschule) FH Joanneum in Graz, Austria. This programme is highly interdisciplinary and consists of elements of the following disciplines: technical and informatics basics, arts basics, graphics design, corporate and environmental design, typography, exhibition design, user interface and web design, media and game design, creative writing. These disciplines are complemented by courses teaching English language skills, presentation techniques, economy and project management. At the end of the first two years of study, students had to decide for one of three majors within the programme.

<i>Major (2001 version)</i>	<i>Main focus of major</i>
(1) Corporate and Environmental Design	print media, exhibition design, advertisement
(2) Interaction and Media Design	game design and media art
(3) User Interface and Web Design	technical skills and human-computer interaction

Table 10: Structure of the majors in the 2001 Information Design curriculum at FH Joanneum in Graz, Austria

In a new version of the curriculum which is currently under construction there are only two majors which in turn combine two main areas each. It is interesting to see that there has been a shift in the meaning of the term „interaction design“ which in the 2001 version has been used to describe game design, while in the 2004 version it is used to describe human-computer interaction and user interface design. The latter interpretation of the term interaction design is in fact the more widely used

one. However it shows that in general the limits between fields and disciplines cannot be drawn precisely and are subject to regional differences, shifts over time, and are interpreted in different ways by different communities (e.g. technical, scientific, artist, and market branch communities).

<i>Major (2004 version)</i>	<i>First focus of major</i>	<i>Second focus of major</i>
(1) Communication Design	print media and advertisement	exhibition design
(2) Media and Interaction Design	media art and design, game design	interaction design (HCI, UID)

Table 11: Structure of the majors in the 2004 Information Design curriculum at FH Joanneum in Graz, Austria

HCI and UID belong to the central disciplines of the curriculum. They are taught in an average of three hours per week across all years of the programme. Like half of the programme's courses, they are of seminar type, which means they are taught in groups of 16 students. As we have 48 students per level this makes it necessary to teach every HCI/UID course three times in parallel. In my opinion the strength of the programme is the fact that it teaches the students a broad skill base in several disciplines, making them well-prepared for a generalist job in industry, in creative companies or as a self-employed. It is evident that in the context of this programme I always choose practical-oriented teaching methods.

Case study by the author on Problem-Based Learning (PBL)

In this section a case study by the author is presented that shows the experiences made with PBL. The method of Problem-Based Learning (PBL) was introduced at FH Joanneum in a course by Jeannette Hommes from Maastricht University, The Netherlands (2001). This teaching method has been developed in Canada and is also used in the Netherlands for teaching groups of up to 12 students in medicine, law, and economics. It has been made the primary teaching method in the industrial design curriculum established in 2000 at TU Eindhoven. Also PBL has been mentioned by Pelle Ehn in his interview as the most important teaching method at his institute at Malmö University. In PBL the tutor does not play a dominant role, but only acts as a facilitator and coach for the learning and working process in the group. He or she will basically set the goals, watch the

group critically, give feedback, and provide necessary inputs in order to make progress possible. The group members work on solving their problem or gathering information between the sessions, and discuss on their findings in the sessions.

For every session two group members serve as the discussion leader and the note taker. Other students may give short presentations of their recent work. Decisions are taken by the whole group, the tutor will only give advice. Before the introduction of PBL, the primary didactical method for usability testing and other research methods like focus groups was a mixture of full-group discussions, teacher presentations, and exercises in groups of three to four students. For the first course using the PBL method the second year students were selected. The topic was the user interface design process of a software product. Although the optimum group size in PBL seminars is 8 to 12, the method has been used for the programme's group size of 16.

The decision to employ PBL in the seminars was led by the hope to enhance the quality of the seminars, make them more appealing to the students and bring them closer to practical work conditions. The available time for the project was 15 weeks, i.e. the duration of the winter term. Apart from this seminar, students are simultaneously involved in several other seminars and lectures up to a total amount of 30 teaching units per week, one unit being equivalent to 45 minutes. So in planning the PBL project the very limited time for "homework" or other students' activities outside the seminar time had to be considered. When starting to use PBL in my seminars I was in charge of creating the timetable for the whole Information Design programme - a very time-consuming task indeed. As a consequence I selected the user interface design of a software tool supporting timetable management for our term project in this seminar.

As the primary teaching aid I used a poster by the Usability Professionals' Association (UPA, 2001). The poster shows a generalised user-centred design process in form of a game path as a sequence of four process phases (analysis, design, implementation and deployment) subdivided in around 25 tasks and explained by 12 short descriptions. The poster is available from the UPA (online).

Additional input for every seminar unit has been given in form of papers or articles by important individuals in HCI like Jakob Nielsen, Donald Norman, Ben Shneiderman, Jenny Preece, Aaron Marcus, Alan Cooper, and Steve Krug, which I distributed to all students. I asked every student to choose one additional article or book chapter of approximately 15 pages and to prepare an abstract based on it. This was intended to enhance the necessary knowledge within the group in order to

face the design and process-related challenge. Abstracts, discussion protocols and other documents created for the seminar were stored electronically on a dedicated disk space accessible for all students and the tutor, as well as in a physical file. In every of the three project groups of 16 students, one student took over the responsibility of file keeper, another one of project leader. These tasks were intended not to be time-consuming in order not to keep these students from active participation in the project.

Experiences from the use of PBL in the UID seminar

Every one of the three groups taught in parallel reacted in a quite different way on the PBL seminar situation. The students were already used to full-group lectures and to small-group projects, but a full-group discussion-based seminar was a new experience for them, as well as for me as the tutor. All three groups delivered valuable results based on good ideas, while group C was most in time and created the best UI simulations illustrating their ideas.

- ✓ *Group A* was relatively hard to motivate for discussions, while some very creative and interesting ideas and design approaches regularly emerged from the quite slowly progressing overall activities. We could call there approach as most similar to „the artists‘ thinking style“.
- ✓ *Group B* felt very comfortable with discussions and was easy to motivate for the new way of teaching, while lengthy discussions tended to slow down the problem solving and creative process. We could call there approach as „the philosophers‘ one“.
- ✓ *Group C* was interested in solving the problem, but considered discussions as unnecessary loss of time. They rather would have tackled the design problem immediately using an activity guideline. Their approach seems to be more like the one of „the technicians“.

During the seminar I learned that it was not possible to use the same approach for supervision and coaching of the groups. The different attitude of the three groups made it possible that a tutor’s statement saying that „our design will be implemented later on by an external company and sold as a product“ was considered motivating by group C, but frightening by group A, and left group B’s mindset unchanged. It is important to note that the division of the students into groups was done

by a random process using the initial letters of their family name. As it was not possible for similar-minded students to join the same group, the different group character could rather be explained by group dynamics and the impact of some more influential students, a phenomenon that can be seen in companies and peer groups as well.

Other challenges for me as the tutor were to motivate the majority of the students to take responsibility for the project, to adapt the elements of PBL to the needs of the ID curriculum, and how to evaluate the students. Usually it was easy for any group to carry out tasks like interview users, create a persona, create a screen design, or prepare a presentation. The students decided to split this job into similar tasks and to carry it out in small groups of two or three, a way of working which they are used to.

On the other hand individual students used certain skills, e.g. programming, to create valuable input for the group. It was difficult for the students, however, to see the big picture of the project, and to take important decisions. This aspect made the gap between the relatively more experienced and knowledgeable students and others more evident than in normal teaching situations. Only the most advanced, say 30% of the students already had the self-confidence needed to take decisions in bigger projects, to take responsibility, and to take certain risks. The remaining 70% of the students may have felt uncomfortable in many situations of the PBL seminar, when the tutor remained silent, leaving the full responsibility with the student group, and when at the same time they did not trust the ability of the leading 30% to take the right decision.

I am convinced that in a PBL teaching situation it is important to be well-prepared like every tutor or teacher. However in PBL the tutor has to wait long enough in order to make the group feel and explore the problem. On the other hand (s)he has to give verbal or written input to the group early enough in order to avoid frustration and wrong decisions. For the author the biggest challenge as a tutor was to find the right moment for taking action in the seminar, which was often at quite different times for the three student groups. The PBL tutor is in the situation of a manager supervising a very self-responsible project group.

There is an approach saying that a PBL tutor does not need deep knowledge in the discipline that is taught by the PBL seminar. While we do not consider HCI and UID as disciplines very difficult to learn, I feel that in case of the described seminar groups, a tutor showing a certain knowledge was quite helpful in order to help the students in keeping the necessary self-confidence in their

decisions. More than this, I believe that for a PBL tutor in HCI and UID a certain experience from managing project groups e.g. in companies is even more essential than general knowledge in the discipline.

A very helpful feature of the described PBL seminars became the existence of an external customer. This customer was found in the person responsible for database administration in our school. By the time the seminar was held, he adapted an SAP (TM) database system for the school, aimed at the integration of all controlling, personnel, and student data. So the scope of his task included the scope of the seminar project, i.e. the handling of timetables and room allocation for our school, which made the design of a user interface a necessary element.

Fortunately it was easy to convince the database administrator of the benefits of user-centred design. An agreement was made saying that in exchange for acting in the role of customer for the seminar project, the database administrator would receive the seminar results for free. I scheduled three visits of guests to the seminar: First the database administrator came for a presentation of the database system and his approach in adapting it to the needs of the school. In another seminar unit a programmer presented a web-based user interface for timetable management, that he had written as a stand-alone tool for the school's department of Internet technology. At the end of the PBL course the results of the group work were presented to the database administrator.

Besides the visits there was no direct contact of the students to the customer, so the activity was not time-consuming for him. Also there was no official agreement or contract for delivering any work at a certain deadline. But the existence of these persons made it easier to represent the constraints that are characteristic for the challenge of UI design in a real multidisciplinary team and for real customers. Another very successful element of the project were the interviews with users carried out by the students. All persons responsible for timetable definition and handling were interviewed by the students. This was interesting because each of the 16 departments in the school has a different approach of doing this. So the variety of user requirements was made very clear to the students. This task was defined a common activity for all three groups, so I made sure that teachers and secretaries were not asked two times for an interview. The three PBL groups had to share their results in this phase of the seminar. The same applied to the next phase, the creation of three user personas (department head, secretary, student) according to Alan Cooper (1999).

Conclusions from the PBL case study

In my opinion the use of PBL in HCI and UID seminars in the context of a design programme and given the practical-oriented didactical concept of a polytechnic (Fachhochschule) was an interesting experience. I am not sure, however, whether the pure and original PBL method should be applied without changes in HCI and UID seminars. As the polytechnic-type education and design education in general are already quite practical-oriented the difference between PBL and other seminars is smaller than for disciplines like law taught at a university. More than this, design students often have a less analytical approach to problems than law or medicine students, making the analytical aspect of PBL less valuable. For all of these reasons I consider a PBL seminar in HCI or UID different from where the method has been created, but nevertheless elements of it can be quite valuable. The PBL experience has been a first approach of the author to make HCI and UID seminars more oriented towards what I considered to be the methods of design education. From the interviewees of this study only Pelle Ehn mentioned PBL as being used at his school in Malmö.

It is interesting to compare some aspects of this experience of group-specific attitudes with a similar phenomenon discussed in literature.

From his own early research work, Lawson (1997: 188) describes some interesting laboratory studies. In the first experimental study, groups of architectural students designing a school have been video-recorded and then analysed for both their words and actions listed in so-called design protocols.

In another study three groups of architecture students after a short period of work on an office building project had to present their ideas and thoughts at an early interim criticism session with their tutors. Lawson reports that the three groups have selected completely different approaches to start working on the generation of their design: (Lawson 1997: 190)

- ✓ *One group* started with focussing on the environmental requirements and had done a literature review. They presented a structural and partition grid.
- ✓ *The second group* had focused their attention on the features of the building site and how to place the building outline within that.
- ✓ *The third group* had focused more on the visitors and the ways of enter the different departments assembled in the building.

Each group apparently has started with another ‚primary generator‘ that determined their approach to the design task. „It is difficult to decide whether any of these approaches are better than the others and it is certainly not possible to declare any to be either right or wrong.“ (Lawson 1997: 190)

These experiences made with the three groups have many aspects in common with what I have seen in my PBL case study reported above.

A case study on studio-based education at the Royal College of Art (RCA) by Fiona Raby

The following case study was recorded as a part of the interview with Fiona Raby. Compared with most of the other answers by Raby and the other interviewees it is outstandingly long and detailed. Therefore I like to present it here in its original form and not interrupted by comments or comparisons to other views on studio-based education. From the original version only a few of my additional questions have been deleted in order to make the case study text more smoothly readable.

The main characteristics of Dunne and Raby’s way of studio-based education at the RCA are:

- ✓ The studio is strongly characterised by the studio leaders’ belief, their way of working and their specialities.
- ✓ The studio takes 12 students per year in average and has two part-time tutors.
- ✓ In every studio there can be both first and second year students of the two-year post-graduate programme. The best situation is to have equal distribution, i.e. six first year and six second year students.
- ✓ The studio leaders advertise their studio at the beginning of the year. They set the framework and explain what are their interests.
- ✓ The students express their first and second choice for a studio.
- ✓ In a meeting the leaders of all studios take the decision on which student will participate in which studio.

- ✓ A project usually spans over one year. The year splits in three terms. There is a different emphasis in every term:
 1. on field work, research or experimentation, doing analysis, creating a hypothesis,
 2. on materialisation or one-to-one prototyping,
 3. on detailed design and on strategy development.
- ✓ In the first term the contact hours take place in form of group meetings called round tables every week. There is group discussion. Later there are also one-to-one tutorials.
- ✓ Over the whole year every student will work on a hypothesis which is likely to change over the whole year.
- ✓ Dunne and Raby as studio leaders are interested in the idea of hypotheses and experimentation. Compared to other studio leaders they do not give a lot of briefing at the beginning. However, there is a general subject for the studio every year, like e.g. „suburbia“. Within the general subject every student proposes his or her specific project.
- ✓ For the second year students can change their project subjects completely. They also can change the studio. By doing that students who had problems before can often turn out to do very good work, e.g. because they feel more comfortable with a different kind of briefing, subject, or tutor.
- ✓ Typically in an architectural school there are four studios for postgraduate students in parallel.

The rest of this section presents the full text of the case study.

3.100 Question 10 What are important teaching methods in your lectures or seminars?

3.105 Raby There are many methods. The year splits, we have a kind of emphasis on each term. In architecture there is a whole year project. Students do one project and it lasts a whole year. But within that there are very many little projects that make up this big project. So the emphasis in the first term is very much on research. The students are going out, they are meeting

people, they are doing research on the Internet, they are doing historical research, political research, economic research, and then we get them to make a hypothesis. At the end of the term when they have all these ideas they prepare their hypothesis in a written way and they have to embody the hypothesis in a project, which is quite a difficult moment. That is not really about methods, but there is emphasis. I guess that's the method that we use. And the emphasis shifts:

3.105 Raby At the beginning in the first term when the emphasis is on research, all of the meetings we have are group meetings. We don't do one-to-one tutorials in the first term, but we do it in groups, we call them round tables. So what happens is that the students go away, they do their research, they come back, and as a group, we go around and see what they discovered, and what their next experiment will be. So it is a continual process. We discuss this as a group and we see what everyone else is doing. To find things out they do also different little experiments depending on what they are looking at. It sounds all very fuzzy, like if there was no structure, but it's a very case-by-case situation, where some students are more technical, but others think more structurally, and others are a lot more imaginative and floaty. We have to deal around the table with all the twelve radically different proposals. Each one will have a different way in which they will pursue their project. It is difficult to say whether we have an overall objective, but the objective at the beginning is very much one to share each other's projects. The students go away, try things out and come back and then we discuss how their state of the hypothesis is.

3.105 Raby In the second term it turns more into materialisation. They make their first presentation at the end of the term where they have their hypothesis and they propose something, usually in a public space. What happens then is that students start to work on two different scales. One is strategy, they work on a bigger overall strategy, like a master plan, what their bigger objective is, but then they have to prove it through one little experiment, like (reduced) in a scale. Then we start to move because we have second year and first year students working together. So I have six students who are first year students and six students who are second year students. That is very lucky. Sometimes the balance is different, sometimes we have nine second year students and three first year, whatever, but this year we are quite equal which is good, because second year students are very demanding. So at the beginning everyone is together, it does not matter whether they are first year or second year. What happens in second term when it becomes materialisation, is that the first year students have a particular one-to-one project where they have to build something in a one-to-one scale for themselves in the workshop, make it themselves and demonstrate it, and they have a

four-weeks project, so we are focusing for them to do that. We are equally trying to get the students to start to materialise their work, but with our studio (=master class), what is different from many of the other studios is that we keep an emphasis on the research. So they have to keep going back into their research and finding more things out. They can't just say, well I have done the research and now I do the design. I must say that other studios do that, they say: That was the research and now we do the design. But in our studio every single experiment the students do is still trying to understand something. So in the second term work is done in a more iterative way.

KB: Could you give some examples of the topics on which students would work in such a course?

3.105 Raby A typical subject for these projects was to look at future social trends, because we were backing them up with real-life evidence. A student worked on a hypothetical condition that if a child is born today, there is a strong possibility that that child could live up to a hundred and fifty years of age, because of some medical and biotechnological advances we will be living longer. As a consequence there will be particular social trends. The student was looking at marriage, how many people will have many marriages throughout their lives as they will become 150 years old. So encouraged by us, the student started to think what the impact on the family could be. She made a hypothetical family tree of up to 150 years, with many children from many marriages, with 73 households with 55 teenagers and six generations. Then she realised that if the grandparents got postcards from their relatives from different families who are on holidays, they would have to manage it both in an emotional way and in cataloguing all this information. So this hypothesis poses really interesting questions. Her first proposal about how to deal with that situation was not particularly successful.

3.105 Raby But in her second term we got all the students to look into suburbia, that kind of customised, mass-produced housing on the outskirts of the city. The ideal suburbia, is that the dream of where you live? All the students had to find a site at the end of a tube line. The student I talked of before found a site in Enfield, you know, one of these strange places you never go to, we laugh at places like Enfield. She found a site where she was developing a housing estate in three phases based on this new hypothesis of living for 150 years. Her proposal was the typical house, how many bedrooms they will have, how much they sell it for, so it became an unique economic as well, what the market required for those kinds of developments, and she wondered about the future of this housing estate.

3.105 *Raby* Then in the second term there is what we call the one-to-one, so the students have to do a real prototype. Also students have to do a thing called a factory visit, where they have to go and see how things are made and manufactured. The student I talked of before chose to look at this idea of one of the elderly people in the family collecting things. She went to a few different places like an archiving place where they archive histories and a microfiche factory, because she really loved the idea of projection and lenses. It is a different way of looking at things: You see things through projection, as a softer way of seeing an image. For her one-to-one she built this strange object, which she could not deal with technically, but she wanted it to be half-digital and half-physical, so there are certain ways in which you could organise the family and understand the relationship between people but change that relationship depending on jealousies, if certain members fall out with each other which they obviously will. So she wants to accommodate that within the device. But she is in a learning process, and it was not that hugely successful, but it was a really lovely little proposal.

3.105 *Raby* The final term in the first year is the last term of the project. It is a very short term and students are then working again on these two scales, the very small and detailed scale and the strategy. So when the student I talked about was working on this state the problem grew. It worked out that her hypothesis started to change. She started to look at the idea that if people are dying and inheritance is being passed down, all kinds of movements of money will take place, so maybe the economy of the family will change. She thought maybe there will be a little swapping and hand-me-down and sharing of property. She came up with this idea and concept of a family group together would buy things that a normal family is not able to have, like a swimming pool building, or a huge dining room with kitchen and entertainment space where all the family could get together for a birthday. If all these people come together for a very special occasion it is like hiring a hall. How can you have family occasions where all come together? As a consequence she had the idea that some of the young people who could not afford to live in their own properties would become caretakers, there would be facilities where the younger people would caretake the facilities and manage them, look after the facilities, as part of their deal for living in a tiny little flat. She called these node houses, and she tried to plan a new estate based on node houses. Obviously the density of the housing estate would increase, so she made a kind of arch with the look of a barret with a nice big presence. When you would arrive in the space, you would feel it looks like a normal housing estate. So these are the node houses, where you live the phantasy of this suburban life, with

a garden and a car and everything, but then you move through under, and behind there would be a huge housing complex where all the people actually live, to accomodate there is more density. Then she had to work on the densities and how to manage it in terms of static.

3.105 Raby In the second year students can change their project subjects completely. So we have again twelve radically different projects in our studio group.

KB: What was the starting point that you gave to the student in order to start the project you described?

3.105 Raby As a starting point for such a project subject we usually don't give very much as a brief. In the Royal College of Art as in many other architectural schools, we have four studios and at the beginning of the year the studio leaders have to stand there and present the studios to the whole school. So we have to say what we are going to do, what is our theme and what we are looking at. We have a reputation in our studio for taking a research approach which is a little experimental. So we are not usually popular and we don't always get lots of students, but we were this year, which is quite funny. So you stand up in front and you literally tell the story of what we think is interesting as the teaching and we set the framework, so we describe our interests. We are interested in the idea of hypotheses, and we looked at Superstudio and we talked about the previous rows of architects setting visions, and how we could bring that into our times, but not in a sixties' way. We are very inspired by a Rem Koolhaas' piece of work which was done when he was a student, but the architecture is incredibly bombastic, and we wanted to look at a much more subtle approach which looked at many different layers.

3.105 Raby So we present and we also give a slight indication on what the brief is, like this year we were looking at suburbia. Some of the other studios do things like, one looks at branding, another one always takes a public building like a library and a police station, or a particular typology of architecture, so we are quite different in respect. Lots of the other studios give a brief like „we will design a town hall this year“, or „we will look at the idea of public private space in relation to the city and how we can break down those barriers“, but we don't. We start with a place - which this year was suburbia - and a topic - which was truth. We always play with the idea of reality and fiction and how we can work to use these two together, the imaginary works together with the real and physical space. And the proposal can be technological. In previous years we always have done themes which were even more technological like virtual space and physical space, but this year

we were focussing on the imagination of what we perceive as being real or technological, not real imaginative space. So it was slightly different.

3.105 Raby So we would stand in front and give a presentation and the students have to choose a first and second choice. And then we do an interview with all those who want to be with us, and we can decide whether that student would be happy with us, because not all students can work in this way. And now I have the experience to know a bit which students will find difficulty. And we do have students who are very unhappy with us and in other studios work really well. But then we have students who can't work in other studios, who come with us and work really well. It is a kind of a balance.

KB: So how do you decide? Does every student have an interview with his or her first choice people?

3.105 Raby We try to give to all the second year students their their first choice because it is their last year. In the first year, they don't really know. To be perfectly honest, in the first year it does not matter. They should experiment and find themselves and work out where they want to be. So we should accomodate most of the first years' anyway. So the second years' students are getting their first choice and because of their previous year, we can judge, whether they are making a mistake doing a second year with us, so we can advise and say, well, really you struggle with that, and it will really be difficult to find your own project. And there are other studios, we have had a few cases of that, where students need a brief, and they work phantastically with a brief, we had two last year who have gone to another studio with a brief, and they are their students, and they were our worst students, which is quite interesting. So then, we negotiate. We see every single student, and it can take a whole day. They bring their (ideas) and we discuss why the want to be in the studio, what they want to do, especially the second years' students.

KB: So you have a big meeting of all the studio leaders and then you decide?

3.105 Raby Then all the studio leaders have a „fight“. It is terrible, but it is quite funny, because you get to know how to play the game.

KB: How many tutors are there per studio, and for how much time per week?

3.105 Raby In a studio there are two tutors for twelve students who meet for one day a week. We - Tony Dunne and I - teach only one day a week. The rest of the time I am in my private

practice and I have to stay away from the students. I am not very good at that, but I have to be disciplined and I do try.

KB: If you have more applicants, do you take more than twelve students?

3.105 Raby If we have more applicants for our studio, which was the case this year, we are in a good position to choose whom we want. But it was very strict this year, and we could not take more than twelve students. I wanted to split it half way. There are occasions where all our students are second year students which is a nightmare. We now have six first and six second year students which is perfect and works really well.

KB: So do they all get the same topic to work? How does every student choose what to do within the topic?

3.105 Raby All students in the studio get the same subject, which was suburbia this year, and we encourage them what to do specifically. They bring all the stuff back and we go through that. We have a discussion on what is more interesting. We meet all the students for a whole day a week. We deal with them one-by-one or they join in other people's meetings. If someone else has done something similar we give feedback on it. It is very much a fluid process. Obviously, with first year students we direct quite a lot. We give certain directions on what we think is more interesting. And then we give them advice on what kinds of experiments they should go for.

Conclusions on problem-based and studio-based education

At this point it makes sense to compare the positions stated by the interviewees with some views collected from related literature. First some aspects of studio-based education are explained by Bryan Lawson.

Lawson states that design education „is largely based on the studio where students learn by tackling problems rather than acquiring theory and then applying it. Learning from our own mistakes is usually more powerful than relying in gaining experience from others. The popularity and success of the studio system has more recently led some design educationalists to assume that all learning can be this way.“ (Lawson 1997: 159)

„There are, however, problems with such a system, for the student is not only learning through the studio project, but is also usually performing and being assessed through it. What might have made a good learning experience may not necessarily have generated a high mark.“ (Lawson 1997: 160)

„Unfortunately, too, the emphasis in such studios tends to be on the end product rather than the process. Thus students are expected to strive towards solutions which will be assessed, rather than showing a development in their methodology.“ (Lawson 1997: 160)

„Often, too, the inevitable ‚crit‘ which ceremoniously concludes the studio project tends to focus on retrospective condemnation of elements of the end product rather than encouragement to develop better ways of working.“ (Anthony 1991; Lawson 1997: 160)

A formal description of design learning is reported again by Lawson (1997: 160). Laxton (1969) developed an elegant model of design learning using the metaphor of a hydroelectric plant. Three skills are necessary:

- 1) The ability to initiate or express ideas based on a reservoir of knowledge and experience.
- 2) The ability to evaluate and discriminate between ideas.
- 3) The ability to interpret, transform or translate ideas into the context.

„Design education, then, is a delicate balance indeed between directing the student to acquire this knowledge and experience, and yet not mechanising his or her thought processes to the point of preventing the emergence of original ideas.“ (Lawson 1997: 161)

While such elegant models always may look too simplistic Lawson makes it clear that we are dealing with a highly complex activity. Also he points out that design thinking is different from scientific problem solving.

„(...) there is not one route through the design process but many. (...) designers use what we might call solution rather than problem-focused strategies.“ (Lawson 1997: 186)

It is interesting to compare these statements with the findings on different styles of thinking that will be discussed in the chapter on creativity later-on in this text.

Practical-oriented teaching versus theoretical foundations

„Certainly it is possible to argue that academically based design education lacks contact with the makers of things, but then as we shall see (...) this reflects practice. The designers of today can no longer be trained to follow a set of procedures since the rate of change of the world in which they must work would soon leave them behind. We can no longer afford to immerse the student of architecture or product design in a few traditional crafts. Rather they must learn to appreciate and exploit new technology as it develops.“ (Lawson 1997: 5)

The same applies to over-precise measurement in design evaluation. „What a designer really needs is to have some feel for the meaning behind the numbers rather than precise methods of calculating them.“ (Lawson 1997: 71)

Lawson brings examples of cases where precise measurements have been applied, but „these tools missed the point about design dramatically“. (Lawson 1997: 71) Nevertheless they have been used e.g. to calculate the heat loss of a building in un-necessary detail, to calculate the savings made by not having doors in office buildings while neglecting all other side-effects of this different design, or to calculate the average daylight in schools and make a minimum daylight factor mandatory which also had several bad side-effects.

Design legislation and regulation often followed similar patterns. Mainly design rules that are simple to measure have been reflected by legislation and become mandatory requirements. But there has also been a lot of criticism on such legislation which mainly suits those who check rather than those who design. Lawson (1997) quotes a report by the British Department of the Environment (1976) saying that „the application of standards across the board defeats the aim of appropriately different provision in different situations. (...) The qualities of good design are not encapsulated in quantitative standards.“

Alexander (1964) proposed to list all requirements of a design problem and then look for interactions between these requirements. For example the design of a kettle has simplicity, performance, jointing and economical requirements. Some of them are conflicting or „interact negatively“, oth-

ers interact positively with each other. However, this view bears some errors. First there is no such „set of requirements which can be exhaustively listed at the start of the design process.“ (Lawson 1997: 76) Second, the requirements are not of equal value and the interactions between them are not equally strong. Third, some requirements and interactions have more impact on the form of the solution than others. Also, the pairs of so-called interacting requirements would be given emphasis at different stages in a design process, so they could not interact.

So the designer usually faces a problem posed by lots of requirements which are maybe measurable on scales, but difficult to relate to each other. To overcome this Lawson (1997: 77) concludes that the designer has to do value judgements. In product design a whole range of alternative designs can be created and produced to fit the needs of different target groups or applications. This is not possible, however, for public buildings, town planning or the routing of new roads where a design can almost never be equally suitable for all users.

„An attractive way out of all the difficulties (...) would be if we could reduce all the criteria involved in design to some common scale of measurement. Cost-benefit analysis relies upon expressing all factors in terms of their monetary value, thus establishing a common metric.“ (Lawson 1997: 78)

As an example Lawson (1997: 80) describes the difficult process to find a suitable location for the third London airport which finally has been built in Stansted. For the members of the commission that had to take the decision it was nearly impossible to balance the needs of people against the protection of the nature, the conservation of historic buildings or financial savings. A member of the commission expressed his feeling to be „trapped in a process which I did not fully understand (...) and which led without choice to a conclusion which (...) I did not agree with.“ Also the cost-benefit research team during the process revised the assumptions on which their calculations had been based.

Not only in public buildings, but also in many safety-related areas design decisions have big implications. Donald Norman (1988) was the first one to blame flawed design instead of human error as at the root of many accidents. His examples stem from the areas of design of workplaces for aircraft pilots, air traffic controllers, power plant staff, ship captains, and medical staff, among others. Often the design errors could have been avoided by the participation of users in the design process.

So Lawson (1997: 81) concludes that:

- 1) Design decisions have big implications e.g. on the lives of people or on ecological factors.
- 2) Objective decision making like in a scientific process is probably impossible.
- 3) Large-scale design processes must invite the participation of affected people.

Since objective decision making and the application of rules seems to be impossible in design processes one could put in question the necessity of teaching any theory to design students. Instead design education like the design itself both could be seen as based on a fuzzy process which is educated best by practical exercise and on-the-job training. Let us now consider what the interviewees said to this interesting question.

4.100 Question 14 Do you see a conflict between theory and practical aspects of your discipline?

More than half of the interviewees do not see a strong conflict between theory and practice in their discipline. Instead, they believe that theory and practice are connected in a nice relationship. Their statements are clustered below. The reasons why they do not see any conflict are somehow different, however.

4.101 Gruber The conflict is not very strong, because theory is usually not very central in architecture.

4.106 Domenig There is no conflict between theory and practical aspects. Theory and reality are always connected. When I do a project I always study the theoretical background first, i.e. I have to do analyses first on the function that it (the building) will have to fulfil. Only when I have this overview, I can start to do the work itself and to translate the goal into a design. But again in architecture like in my work there is always this totally interconnected dependency between function, construction, technology, material and design.

4.108 Gründler There is no conflict. But most of the students expect knowledge prepared like a kind of „cooking recipe“. We cannot teach like that. We rather teach basic underlying principles that are independent of the application or implementation. That is why theory plays an important role in my lectures.

4.109 Heufler I would say that we do not see this as a conflict because we can design the

Conflict between theory and practice, consequences:

- ☒ No. / There is no conflict. / There is not a strong conflict. / Theory and practice are connected in a nice relationship. Dom, Gru, Grü, Heu, Kip, Raby
- ☒ Sometimes there is a tiny bit of conflict. Raby
- ☒ Yes. / There is a very strong conflict. Ehn, Hir , Kra
- ☒ Students should be trained in a broad range of practical and theoretical skills. Dom, Ehn
- ☒ It is important to learn theory, basic principles and how to work on their own. Students often mistakenly expect "cooking recipes" from theory. Grü, Kra
- ☒ I use practical examples to teach theory. But it is not sure whether students will extrapolate the knowledge in different situations. Zim

- ☒ Practical work and making things is central at the school. Gru, Kip, Raby
- ☒ Many design schools emphasise theory. Their students face problems later on. Heu
- ☒ Sometimes bad designers rather talk about design. This is problematic. Gru
- ☒ There is a discrepancy between theoretical expectations and real technological benefits. Kip
- ☒ Students need to know theory. Later they can violate the rules if it makes sense. Zim
- ☒ The students' background influences their theoretical or practical competence. Ehn
- ☒ The unsolved question is: How can an artefact become an argument in a thesis? Ehn

Solution proposals for the theory-practice dichotomy in education:

<input checked="" type="checkbox"/>	Have students and research staff work next to each other.	Ehn	
<input checked="" type="checkbox"/>	All researchers should teach; all teachers should do research.	Ehn	
<input checked="" type="checkbox"/>	Strong co-ordination.	Hir	
<input checked="" type="checkbox"/>	For students, practical constraints are not so central. They can have visions and dreams and do experimental projects.	Dom	
<input checked="" type="checkbox"/>	We should not focus on a specific medium but on general design principles.	Dom, Hir	
<input checked="" type="checkbox"/>	Force central European lecturers to learn didactics.	Grü	
<input checked="" type="checkbox"/>	I talk a lot on my own work. I use interdisciplinarity: Short chunks of theory mixed with music etc.	Kra	
<input checked="" type="checkbox"/>	Teaching theory and practice should go hand in hand in small portions.	Heu	
<input checked="" type="checkbox"/>	Practical experience with materials and crafts is indispensable.	Szy	
<input checked="" type="checkbox"/>	All teachers run their own design office part-time.	Heu	
<input checked="" type="checkbox"/>	My seminars are closer to doing than to thinking on it.	Gru	
<input checked="" type="checkbox"/>	Theory is like a mould where you cast concrete into. The content is the result.	Kip	
<input checked="" type="checkbox"/>	Theory of the arts is important knowledge for architects.	Szy	
<input checked="" type="checkbox"/>	Theoretical foundations are important. They cannot be acquired in self-study.	Hir, Grü	
<input checked="" type="checkbox"/>	Theory leads to successful practice.	Grü	
<input checked="" type="checkbox"/>	Use practical problems to lead students to theory.	Grü, Zim	

Table 12: Conflicts between theory and practice, proposals for a solution and influence on design teaching.

course structure ourselves and; therefore, we can get through the combination consequently beforehand: the theory supplements (the practice) or one should almost say that the practice often supplements the theory. - On an international level there are many design schools where emphasis is put on theory and then in the transition to practical work massive problems are experienced.

4.102 Kipcak Media design and media art is a very broad field without defined borders. Sometimes theory of art and the applied media art are so far from each other that it is even hard to establish a link between them, so this is why there is no conflict. Sometimes we (even) have to simulate the conflict in order to perceive it. Is media theory a theory of art?

After these five educators who are working in Graz, Austria and who do not see any theory-practice dichotomy, we could believe that it is a local phenomenon. Only Raby agrees in her statement and thereby represents a view from Great Britain. In the second half of her statement she admits, however, that there is „a tiny bit of conflict“, which is rooted in the limited attention spans of art students.

4.105 Raby No, we don't have that, partly because it is a college of art and design, and the whole ethos is about the applied arts. And as a result, the whole school is full of workshop places, it's a making place. In fact the humanities come in, and they do the theoretical part. In fact they do a whole lecture series which is very good, they are a kind of funky people. They know that they have to engage with art students, because their attention spans are not very long, so the lecturers have to be very stimulating. So there is a tiny bit of conflict, but as I have said, our studio is more research orientated, they have to more read and find out things and go out and back up their hypothesis by finding out things. We try to make a relationship with humanities, and finally we attract students that are probably a bit more theoretical than practical, so there is quite a nice relationship between the humanities and us.

In contrast to the statements from six educators above there are the following three educators who see a very strong conflict and thereby have a clearly opposite point of view. Van Kranenburg explains this conflict with a similar argument than Raby did.

4.103 Kranenburg The dichotomy between theory and practice is incredibly strong. Especially in arts education the teacher represents a book, which is a very old medium for the students, a boring medieval medium.

The conflict is seen as well by Ehn who presents two strategies for solutions that have been developed at the School of Arts and Communication at Malmö University, Sweden, and are clearly influenced by Donald Schön's work on educating the reflective practitioner (1983, 1987).

4.104 Ehn There is always this conflict. As we are trying to solve this we do the work *as studio-based as possible*. From undergraduate level to PhD and research, in every level there should always be a production part and a reflection part. On every project there should not only be a reflection part alone, but on the other hand there should not only be a production part alone. So that is our general ideology. Some of our students go to more practical classes, others do not. In the first year, all of the 200 students that start every year, in the first year they share a course in cultural history and cultural theory. So even if you are very hands-on this is a common platform of the values and to create a basis for the language to be shared. In the second year they have a joint course on design theory. In the third year they have again a joint course on epistemology and research methodology.

Ehn's second solution proposal has a lot of relevance for the issue of interdisciplinarity that will be discussed later-on in a dedicated chapter.

4.104 Ehn Another thing that links them together is that across different programs we have two things: Once a semester we close down the school for two weeks to do *workshops across the programs*. A workshop could be either theoretical or practical. It could be theoretical like say „Wittgensteins notion of language games and its relevance for design“ or it could be „Playing blues guitar in a group“. So it could be this wide range. Another integrating aspect or factor is that the first and second year students also do joint projects across different programs.

Finally Ehn also tries to explain why the roots of the theory-practice dichotomy in education can be located.

4.104 Ehn And then you can say that in some programs, we have four undergraduate programs: Interaction Design, Media and Communication Studies, Performing Arts Technology, Physical and Digital Design. The Media and Communication programme is by its nature more theoretical and analytical and the Performing Arts Technology is the more hands-on and practical one. So there is a difference between the programs. There is a kind of dilemma with the students. Of course the Media and Communication Studies students become strong in theory whereas the

Performing Arts Technology students become stronger in practice and less good in theory. Another problem that goes with the distinction between theory and practice work is that the skills to write are very different. So if theory is the way to form arguments in a discourse, the writing skills are quite varying, and this has an influence on the student's theoretical competence.

Similarly Hirschberg detects a big conflict which he apparently has always experienced during his time as an educator at ETH Zurich, Harvard University and TU Graz.

4.107 Hirschberg It is big, care has to be taken that it does not drift apart – this has often happened. In Zurich Prof. Schmitt lectured on the topic and we had to do the practical exercise. And one could notice that some students only went to the practical part and skipped the lectures; and from this I always took the logical step, that is to combine these as much as possible. Whereby there is always the danger of talking about software too much. That means, the practical use changes dramatically in the speciality, and the theoretical basis should give the people support that they do not lose themselves in this button pushing, but develop an understanding of what is actually being done. But at the same time we have to make sure that, with all these theoretical representations, we do not lose the relationship to application in the eyes of the students.

Zimmerman does see the conflict as well and presents a solution proposal that is based on his background in drama and film. It is an application of an argument that is often used saying that a student needs to learn the rules first in order to be able to break them in a controlled and appropriate way later-on.

4.110 Zimmerman Yes, and that's one of the things that I try to expose the students to. Coming from industry prior to teaching, I realise that theory is fine but in the end making things is more important and you need to know when to follow the rules and when to not follow the rules. Occasionally breaking the rules is the right thing to do. To offer an example that is probably meaningless but it makes sense to me: There's a rule in a comedy that you want to let the audience in on a joke. A classic example of this is *Tartuffe*, where *Tartuffe* is making advances at his host's wife and what's funny is that the audience knows that the host is under the table hiding and is hearing this. So they don't reveal this until the end that he has heard this, but what is funny is that you are building tension by realising that somebody is under this table and even though you can't see them you know that they are getting more and more angry and so when the husband is revealed at the end it's actually much funnier than if the audience doesn't get that tension built up. Now occasionally

you can violate that rule so you go out of theory and be more successful, and a classic example of this is the movie "The Crying Game" where it suddenly revealed that the love interest is not female but is male, and it's quite shocking, the film makers could have decided to have the audience know the whole time and then see it revealed to the protagonist would have had that tension built up but the shock in this case outweighs the tension that they could have achieved. Another example of a very poor movie called "Down With Love" violates the rule but does it in such a way that the audience doesn't care, so they don't build the tension and then the revelation is so insignificant they end up with a very poor product. I try to give my students theory as much as I can but try to also teach them that they shouldn't be afraid to violate it, but they have to test if violating it is actually achieving a better result.

In literature a related argument is made by Gedenryd (1998: 1) who states that design methodology based on logic principles and procedures does not work, and consequently designers don't work that way.

Cognitive science is about to question conventional design theories as well. „There is a growing body of work on making sense of authentic cognitive activities beyond psychological experiments and computer simulations.“ (Gedenryd 1998)

However, Gedenryd (1998) points out that there is still an absence of a real theoretical alternative that can account for this growing body of knowledge.

While some of the interviewees in this study already explained their position and gave examples, most of them gave explanations for the theory-practice dichotomy in design and the consequences in reply to the following question from the interview guideline.

4.200 Question 15 If yes, how do you deal with this conflict?

In his solution proposal Heufler advocates part-time professors who run their private practice - a situation which will be discussed below in a dedicated chapter of this text.

4.209 Heufler We deal with this in that at this college all lecturers are also in practice. To differing degrees our professors are employed part-time and they run their offices to an extent that the teaching does not come too short.

A clear credo for the necessity of theory is maintained by Hirschberg and Gründler.

4.207 *Hirschberg* Strong co-ordination with a simultaneous maintenance of these two tracks, (it means) that one has to insist on theory.

4.208 *Gründler* My credo is: Theory leads to successful practice. That is why I bring theory and related practical aspects close after each other in my lectures.

On the other hand Gruber holds a position where the practitioner is central and some design theorists and theory-focused design lecturers are criticised.

4.201 *Gruber* Sometimes people who are not good in designing things prefer to talk about design. This is problematic.

Van Kranenburg has mentioned earlier that in the schools where he teaches he represents the theoretical extreme of the range of standpoints, but he has made big efforts to overcome this problem. Also he makes clear what his critical position to industry and goal-directed education is.

4.203 *Kranenburg* I have 10 or 12 contact lessons, and I need to create confidence among the students that theory is necessary in their art projects. I say theory is the sand in your shoes that reminds you that there are other alternatives. There is a bigger context that you need. I don't need to teach content, they will read it themselves. I will tell them several small stories. They will ask me what is the red line in it. But there isn't any, that's life, nobody will guide you. If you want to be a good designer you should be able to pull yourself out of the mud, every time again. If you are not a good one, you just go and work for a company, and they tell you what to do.

An even more philosophical and wide-reaching answer going beyond the scope of didactics is given by Kipcak who sees the theory-practice dichotomy in close correlation with social phenomena and technology-driven changes of society.

4.202 *Kipcak* When the Internet became a social utopia and a field of political projection I noticed a conflict between the wishes and expectations and reality. Now the visionary hype has disappeared and so the conflict has disappeared as well. Now there is only a slow but constant change in the relationship between the public and the media. There is a discrepancy between the theory of self empowerment or democratisation and the real changes that are much smaller, slower and driven by business interests.

Finally Ehn demonstrates again that the theory-practice relationship has been already a matter of considerable thought in his Swedish community which certainly holds an advanced and distinguished position in this respect. Also he points out what are the open questions which show the direction for future work in this area.

4.204 Ehn Let me give an example: The typical thesis of a PhD student would be a combination of written work and some design work, e.g. some installations, some prototypes, some „gestaltet“ (designed) piece of work. A really interesting question, which we have not solved, nobody has solved yet, is: *How can an artefact become an argument?* This is what we are circling around. A PhD thesis has to be an original and valid argument within its field, but the form of the argument is open to something that is multimedial, it can also use other instruments than the text, but the text will be there. - In the lower level in interaction design, it is more practical, yes. - (KB:) *Do you combine your educational activities with some of your practical work?* - (Ehn:) Yes. When we made the new buildings for our schools the research ateliers have been placed to the right and the students' rooms are to the left. Many of the masters students do their master thesis work in the research studios. It also happens and is quite common that the research studios or ateliers suggest student projects which are then carried out in cooperation with the research studios. It is also the case that all researchers also do some teaching. I would hope to say vice versa, but actually not all teachers do research.

The interesting book by Gedenryd stems from the same Swedish community. He emphasises that in both fields design theory and cognitive science there is „a gap between the ideal and the actual which needs to be filled with a new explanation, a theory of human performance in these authentic activities.“ (Gedenryd 1998: 2)

Gedenryd (1998: 4) states that the 20th century developments in design theory are a prototypical example of science driven by ideals, and its shift into the approach (...) to ‚make sense‘ of authentic human activities. He makes a point for a human-centred design and design theory.

„After a century of measuring people by the standards of formal logic, mathematics, engineering, statistics, and so forth, we are slowly beginning to measure them on their own terms.“ (Gedenryd 1998: 6)

Gedenryd (1998: 6) describes „a transition from a view of cognition as basically ‚intellectual‘ to one where it is instead conceived of as ‚practical‘ by nature.“

More than this, Gedenryd (1998: 8) performs a shift from cognition as intellectual to cognition as ‚intramental‘, which means located within the human brain. Then, instead of the traditional, sharply delimited schema of cognition as an intramental process, Gedenryd (1998: 12) adopts a wider and less distinctly circumscribed view of cognition where not only the mind but also action and the physical world have roles.

A similar change of paradigms could also be adopted by design education and shows a way to better integrate the worlds of theoretical and practical knowledge. In the daily practice of design educators there are different ways of bridging this gap, like the following section shows.

4.300 Question 16 Does this influence your teaching?

As it can be seen frequently in this interview-based study there was a high degree of redundancy between the questions circling around a topic. Here again, several answers have been already given above, but in the cases where I followed the interview guideline I „insisted“ on getting more detailed information. Hirschberg apparently found that everything has been said already, which is perfectly understandable in this context.

4.307 Hirschberg Yes, clearly.

On the other hand van Kranenburg still elaborated on his way of dealing with the theory-practice dichotomy by explaining a very concrete technique. Like Raby mentioned above he also has to cope with the limited attention span of his students.

4.303 Kranenburg In my lectures I deal with the conflict by talking a lot on my own work. My didactical concept is that I start with one hour of music, for example by Bach. The lesson will only last for ten minutes, then one minute of break where we all run around and jump up and down, then again ten minutes of lesson, then a break for five or ten minutes, then again ten minutes of lesson and then everybody goes home, because there is no way to keep them longer, and there is no point as well.

Ehn stated that theory and practice are nicely correlated in the whole institution.

4.304 *Ehn* Yes, we use the outcomes of our research in teaching very deliberately. We have practical projects that go outside but we have the studios in the school. - My research or design activities are part of my contract with the school.

An interesting point is made by Kipcak who allows a high degree of self-responsibility to the students setting their own targets. Also he again gives a clear statement about practice being central and theory serving as a tool.

4.302 *Kipcak* In my seminars the point of orientation is always the expectation that the students set to their own work. A student can have theoretical ambitions in a sense of a high degree of abstract thinking in his/her project, but my students' work has always to aim towards a visible goal. Theory will be a topic of discussion only.

As opposed to this Gründler's aim is to provide theory in his lectures. As a consequence he uses practical examples as a tool. He combines this with some strong criticism about the central European academic tradition as opposed to the Anglo-American one.

4.308 *Gründler* Also my credo is: If possible, use practical problems to lead the students to theory. Not like in central European academic tradition, where a big theoretical work comes first, and only then you may be allowed to apply your knowledge. If you start with applications, students will learn theory much easier. University pedagogy has a problem in central Europe. It has no relevance in Austria and Germany. You can make an academic career without any good didactical skills. Evaluation by students has no tradition.

While Gründler's criticism is certainly shared by many who have lived or worked in Austria or Germany, we can find similar aspects of criticism about artificial theory in the American view expressed by Zimmerman as well.

4.310 *Zimmerman* Well, you know, I think every teacher has their own style and to some degree every subject lends itself to certain styles. Design theory, I think is quite abstract without application and the rules seem very artificial until you can really understand the why of the theory. So my approach is to give my students very practical assignments, to give them just a little bit of theory just enough to get them started in the right direction, then to constantly meet with them so that they are not moving too far forward and then as they approach different decisions give them a little piece of theory, the right piece of theory at the right time. And what I've discovered in just

my few iterations is that gives them better recall of what the theory is and how it might be applied. What I don't know - and it is a little scary to me - is that whether they can extrapolate and extract that theory and apply it in completely different situations. I only know that they can apply it in this specific situation. So I think there is quite a danger to my approach.

At this point the guideline again separately focused on both practical and theoretical elements in design teaching.

4.400 Question 17 What role do aspects of practical work play in your seminars or lectures?

Clear statements in favour of the practical aspect are given by Kipcak, Gruber, and Heufler.

4.402 Kipcak A relationship to practical aspects is essential.

4.401 Gruber The relationship to practical work plays an extremely important role in our teaching. We prepare our students for a career in practical work and not an academic or research career.

As already mentioned earlier Heufler's approach is to ensure a balance between theory and practice by the right selection and mixed involvement in teaching and practice of his lecturers.

4.409 Heufler As I have said it plays a big role, and by the fact that the lecturers are also in practise it is guaranteed. Therefore a refreshing every four years or something like that is not necessary.

Szyszkowitz even goes so far as to ask for a training in every design-related craft in order to become familiar with the materials used.

4.411 Szyszkowitz Practical aspects are indispensable in teaching architectural design. You need to experience the feeling of three-dimensional built spaces, of form, of surface, of texture and structure. One cannot make architecture in an isolated „ivory tower“. An architect needs to have carved stone and hurt his/her finger one time in life in order to get a feeling for the material.

In contrast to this Hirschberg goes for a limitation of what design education can provide to the students.

4.407 *Hirschberg* I think it is important to try and teach "First Principles", therefore what we teach is not directly related to architecture, but has more emphasis on the possibilities of the medium, where it is my opinion that one should use the university to the effect of enabling a complete understanding, to try to find these "First Principles" and to establish a deep understanding from this, that the students can then transfer to practical situations. The implementation is then their responsibility.

Raby presents an interesting case study on an interdisciplinary project she recently did in education. It is a quite outstanding way of integrating science and design.

4.405 *Raby* I think that obviously our seminar is heavily influenced by the work that we have done for the last years, it can't not be. So it is heavily influenced by the ideas that Tony (Dunne) and I have been developing. But I think in many ways, I always see it as we are working together. The students are helping us understand things, and we are helping them understand things. There is a kind of exchange going on. So we always talk about the way of working is a kind of „ginipigs“. They are doing experiments together. We don't always know what the outcome is going to be. Like we decided to make a film one term, to see what happens. We test the ideas that we are thinking about. In our own practice at the moment we become obsessed by biotechnology. One of the research questions in our own research was, how can design play a role in the bioethics debate? Can it raise awareness by making things tangible, can it actually help people to see alternative futures? So we thought, we are going to make this hypothesis, let's try it. We do this project every year in interaction design, and at the time we are working with Irene (Mavrommati). So we asked her, can we do biotechnology in interaction design, does that count? She was very open and said, let's try it. So we did an experiment with students. There was a four-week project, hardly any time, exposed them to lots of research that we have found, just to see what they do, because we had no idea what would happen, whether they would find it interesting, whether they could come up with some design proposals or whatever. And we had group discussions again, and we would go away and do the same thing. Obviously, in only four weeks there is very little you can do, but that was an experiment. We used the word research we were doing, to try to understand something we were doing, but equally they were learning from us about the value systems that we had in place.

Finally Domenig who has influenced a generation of architects studying at TU Graz has a relaxed attitude and makes a point for pushing back the constraints of reality and maintaining a zone of free experimentation for university students.

4.406 *Domenig* Practical aspects are not so important, because the students at the university should still be allowed to have visions and dreams. But I tell them that this will be different out there. In real life you have to struggle with all these limitations. It is similar for an artist: Either you go the conventional well-known way or the experimental way. If you go the experimental way in architecture you will have to face many enemies. When the building is constructed they still do not believe you. When the building is in use for a few years and we all see that it works, you slowly get some credibility. But it is only much later, after some 30 years, that they will love and honour you, but then you will not be alive any more.

4.406 *Domenig* What I tried to teach the students is that architecture does not depend on a building, but on my own way of working. My biggest building is the ReSoWi centre in Graz, the building of the Graz university's faculties for law, economy and social sciences. My smallest object is a piece of golden jewellery in form of a bird which will be worn by a woman. In architecture you need to deal with the environment of every object you design, and that may be a city or a woman. In my understanding of architecture, it is not directly related to anything, but it is universal and includes functionality, aesthetics and art. I am an artist as an architect. But there are different approaches; other architects develop the current trends further. I try to do completely new things. So when I am teaching students I focus on this universality and not on the dependency between architecture and a building.

As nearly everything had been said already on theory and practice there did not remain many interviewees who answered the next question as well.

4.500 *Question 18* *What role do theoretical foundations play in your seminars or lectures?*

One view on this issue is taken by Gruber who repeated his position in other words.

4.501 *Gruber* Theory is important, but in my seminars I am closer related to doing than to thinking on it.

Kipcak uses a metaphor from construction engineering to provide a very balanced position.

4.502 *Kipcak* Theory is like a mould where you cast concrete into it. When the amorphous content has hardened or the piece of work has manifested itself, you will remove the wooden container. The piece of work will have to stand on its own. My relationship to theory is similarly defined by practical needs. I have fear of a theoretical corsage which will immobilise myself.

As he did not see a big conflict Heufler takes a very balanced position as well.

4.509 *Heufler* Actually this is clear. Relevance is always given and parallel to this it is supplemented, by means of theoretical knowledge e.g. in the form of design theories developed at universities or colleges. - *KB: Is theory taught first or does the need develop when discussing practical examples?* - *Heufler*: One can say that they go hand in hand. Theory is treated in small portions and directly afterwards in the same lecture it is addressed more thoroughly.

A quite different position to these is explained again by Gründler and Szyszkowitz.

4.508 *Gründler* Theoretical foundations are very important for me. Students should get the competence to act and know what they do. I do not follow any school of theory, however.

4.511 *Szyszkowitz* Theoretical knowledge like the history of arts is fundamentally necessary. Buildings, objects or details can be based on a context of ideological roots. How do I get to a form which goes beyond the purely necessary and functional? Why do I add anything more? Why do I create forms in furniture that caress the eye, while they are not ergonomically necessary? These things represent the ideology of the architect, and they are based on theoretical foundations.

Hirschberg gives some examples for what he considers as essential knowledge for a designer.

4.507 *Hirschberg* I think that the theoretic fundamentals are very important. To always be aware, it is exactly the things that are not picked up in self-study when one tackles a certain software, I often discover that one can enlighten people who have worked a long time with computers, when one supplies them with the fundamentals, that had till now escaped them. - *KB: Do you mean, for example, mathematical or geometrical fundamentals?* - *Hirschberg*: More computer graphics, how the things work, not so much the mathematical things. That one can show where this process comes from, without knowing it in detail, how long it has been available, and that it exists in different

clearly positive	<input checked="" type="checkbox"/>	Domenig	Kranenburg	Szyszkowitz
rather positive	<input checked="" type="checkbox"/>	Heufler	Kipcak	Raby
rather negative	<input type="checkbox"/>	Gründler	Hirschberg	Zimmerman
clearly negative	<input checked="" type="checkbox"/>	Ehn	Gruber	

Table 13: Attitude towards presentation of own work AND relationship of teaching and office (combined).

programs in similar forms etc. - *KB: Lighting models?* - *Hirschberg*: Lighting models are a very good example. Or also the principle functioning of CAD programs in geometry etc.

Finally van Kranenburg refers to some of his examples. Paulo Freire is an important Brazilian educationalist, while Antonio Gramsci is an Italian revolutionary philosopher.

4.503 *Kranenburg* Basic theory is pedagogy by Paulo Freire and Antonio Gramsci, and didactics is learning by doing and getting experience.

Relationship to private office and own work

The next two questions are very much related to each other. For better overview I created table 13 which combines the two questions but, however, over-simplifies the answers and relies on my own interpretation. We can see that the answers show the full spectrum in the most equal distribution possible. While it is not justified to do anything like statistics with such a small number of interviewees it can nevertheless be concluded that there are exponents who have - and good arguments for having - any of the possible attitudes towards the involvement of a design teacher's own work and his or her own office into the teaching activities.

YES (5)	<input checked="" type="checkbox"/>	Dom, Heu, Kip, Kra, Szy*, <input checked="" type="checkbox"/>	(Raby)
NO / only in some respect (5)	<input checked="" type="checkbox"/>	Ehn, Gru, Grü, Hir, Zim	

Table 14: Relationship of teaching and practical work (private office)

*note: all who have an office answer with YES.

YES	<input checked="" type="checkbox"/> Kra, Szy
YES with restrictions	<input checked="" type="checkbox"/> Hir, Grü, Heu
YES only for better understanding	<input checked="" type="checkbox"/> Zim
NO / hardly / less and less / only students' work	<input checked="" type="checkbox"/> Gru, Kip, Zim

Table 15: Attitude towards the presentation of examples of own work in lectures or seminars.

When we look at table 11 we can clearly recognise one simple pattern in the distribution of names: All interviewees whose name appears in the left half of the table own their own private practice, all others do not. This effect also becomes clear from the answers to question 4.600, while it is not so clear from the answers of question 4.700.

The answers to question 4.600 - do you relate your teaching with your practical work - are very easy to explain. Those five interviewees who answered with „yes“ all own their private office for design or architecture. The question was not explicitly addressed in Fiona Raby's interview but during the interview she talked about working on the same topic in her seminar and in private practice, so I put her name in brackets. Those interviewees who answered with „no“ do not own their private office. They are all full time educators. Joseph Gründler and John Zimmerman mentioned some relationship with their activities as an artist or researcher, but this is probably true for all five interviewees who answered with „no“.

In addition to what has been said above it is interesting to notice that some of the interviewees mention that they mainly present their own work in order to show their own failures (van Kranenburg), to become more of a friend to the students (Zimmerman), or to explain them that in the beginning of the design process they did not have any idea at all (Szyszkowitz, 4.611).

The following two sections present these interesting statements in detail.

4.600 Question 19 Do you relate your teaching with your practical work, e.g. as an architect, as a civil engineer, as a consultant, or with the work of other professionals?

First the answers are presented from those interviewees who are in favour of relating their teaching with their practical work or private practice.

4.602 *Kipcak* Yes, because dealing with my practical daily work is indispensable as a didactical tool.

4.603 *Kranenburg* Yes. Together with Alan Munro we founded a design company for facilitate cooperations in the field of RFID tags and the ubicomp environment.

4.609 *Heufler* (Yes.) Answered before.

An interesting statement about originality, inspiration and the initial phase of the design process is made by Szyszkowitz. He quotes himself as when he talks to his students in a lecture situation.

4.611 *Szyszkowitz* Yes this is always present in my teaching. It is necessary to become credible. I have colleagues who are not practitioners, they are much less credible for the students. I tell my students: I have done so many design competitions in my life. Do you think I always had plenty of ideas? Often I had no idea at all! I sat in front of an empty sheet and had no idea what to do. In this situation you do not have to become desperate. But the idea does not come over night. It is based on hard work. You need to walk around and get inspired, or read a book which is related to a certain mood or atmosphere. You need to narrow the scope or field. E.g. if you plan a public library, it is all about quietness, good lighting, and comfortable sitting, good haptic quality. If you add these parameters, the architectural design will suddenly follow by itself.

Similar to a statement Heufler made earlier Domenig locates the connection to practice mainly via the guest speakers who are active as designers or architects.

3.106 *Domenig* During all the decades I always invited guest speakers, international architects and people from theory. Frank Gehry visited me three times. Zaha Hadid had a two weeks seminar here. So the students get an overview on what happens worldwide and how other important people work.

There is no statement by Raby specifically made to answer this question, but from what she said at other moments of the interview we can assume that there is probably some relationship between her teaching and her practical work. On the other hand there is a series of negative answers by the other half of the interviewees.

4.601 *Gruber* Not for the moment. But I have been working as an architect for many years.

4.608 *Gründler* Only related to practical aspects, but not related to my aesthetical believes.

4.604 *Ehn* Generally we don't have that. However, we just created a collaboration with a business incubator outside the school. The reason is to have the chance to take student projects and research projects into enterprises or to help make that leap. We just started in setting it up, so I don't have any concrete examples to point at.

4.607 *Hirschberg* Not at the moment. Before I started at the university I worked as an architect, and later I had a multi-media company where we worked in the Internet providing sector. When I went to America I stopped working, or worked on low flame. And since I have been back in Graz I also do not work privately. I plan in the medium-term to start again. But at the moment this is not the case.

While he does not work in private practice Zimmerman states to establish links between education and his research activities.

4.610 *Zimmerman* I teach and I do research which are somewhat completely separate activities. So I use - „use“ it's a rather harsh but true term - I use my students to help me broaden my understanding of a topic. E.g. right now I'm working on a project that's about computer agents and one of the assignments for my students will be to design methods of interacting with agents. They get exposed to the theoretical framework of adaptive interfaces and I get to mine all of their various viewpoints on how people might want to interact with agents.

4.700 *Question 20* *Do you present examples of your own work in your lectures or seminars?*

This question at first glance may look quite similar to the previous one. Interestingly enough it generated quite different replies. Some interviewees said „yes“ to question 19 but „no“ to question 20. The two of them who agreed both times are quoted at the beginning. Szyszkowitz again shows that he likes to emphasise the importance of experiencing architecture with all senses and to get a feeling for the materials.

4.711 *Szyszkowitz* Yes I do. I present examples of built architecture in order to support learning. If a student for example has never experienced the interior of a church, this is a shame for an architect. He or she would need to be forced to spend two weeks inside a church and feel the three-

dimensional properties which do not only exist in space but also through the acoustic of the room. You need to see, feel and hear the old marble floor, run on it and hear the sound of your steps.

Van Kranenburg gives an interesting explanation for showing his own work to his students. This reminds me a statement by a Scottish educator who also runs a consultancy together with Rob van Kranenburg, Alan Munro (2001): „Tried a hundred times, failed a hundred times. Try again, fail again - fail better!“ Also there are some parallels to Michael Szyskowitz‘ statement 4.611 above.

4.703 *Kranenburg* Yes, primarily I present my own failures. First I want to build trust, then I tell them about all the failures. As a teacher, you are always an example. When you stand like nothing can happen to you, the students may believe you, but then it seems to be very hard to attain this position for the students. Also I want to take away the fear of failure from the students, because this fear can take away half of their energy.

In contrast to this, the following three interviewees only with restrictions present some of their own work in their teaching.

4.708 *Gründler* Only to demonstrate how something works, but not to demonstrate aesthetic concepts.

4.707 *Hirschberg* My work. A lot of development and research from the past years do actually go into the development of the environment of the course; as far as this, I use these things directly in the course. Software was written as a group or partly by me and this has been used by the students. And naturally also things that I do outside of the university are shown as examples during the lectures.

4.709 *Heufler* All our lecturers combine – one must differentiate this a bit more. We let our experiences flow into the training. But we take care not to mix study projects with our own work. This is strictly separated, because otherwise the problem of competition in an incompatible sense arises, that is in the sense of (a competition between) a subsidised college versus a civil engineer or office. – This is strictly separated and it pays, because otherwise – one also notices this at other colleges – so secretly one always knows that students have made something and that it was not made in an office. – In this sense there is an integrated „technology transfer centre“, however we fully integrate the transfer projects into the teaching. This means – little example – we are doing a car study for Audi (TM). The briefing is drawn up together with Audi, we carry out the course,

for example often with an invited guest professor. But we take care not to bring our own work to the college - or not have it done here, because here we cannot separate it properly.

4.709 *Heufler* I present my own work (in the lectures), and my colleagues also do this, because it is really important, and because we can say a lot more about these projects, give much more background information, compared to some public outside project. And this increases our authenticity with the students.

So Heufler differentiates between having his students work in his own projects and showing his projects to the students. This example makes it clear how difficult this issue can become because not only the graduates will be in concurrence with the teachers, also the school in its position as a self-financed company will find itself in concurrence with local industry. This is a new situation for Austrian universities since 2004 and a well-known situation for Austrian polytechnic schools since their foundation in 1994.

On the other hand Zimmerman is quite restrictive with showing his own work to his students.

4.710 *Zimmerman* Very rarely do I present my own work because I don't want to make them think that there's a right way of doing things. Generally everything I present I critique heavily and it's a difficult situation to objectively critique your own work. As much as I can I try to avoid it, but I might share in a very different context some of my work, less to help my students understand design but more to give them a little insight into me so I'm becoming more like their friend.

At the end of the possible range of opinions there are the statements by Kipcak and Gruber this time.

4.702 *Kipcak* I did but I am doing so less and less.

4.701 *Gruber* No, I hardly present any work from myself. I rather present students' work from previous years.

Conclusions to the theory-practice dichotomy

Outside the field of design didactics the theory-practice dichotomy has been a widely discussed issue as well.

Gedenryd (1998: 122) reports of an experiment by Kirsh & Maglio (1992) with subjects playing Tetris it has been shown that people use the outside world to improve cognition. Physical actions often cause less errors and are quicker than their mental representations.

This strategy has also been described by Dewey (1929: 87) as „doing for the sake of knowing“. This is applied „when we are trying to make out the nature of a confused and unfamiliar object.“ and is an example of an activity called inquiry which helps to bridge the gap between thinking seen as theoretical and doing seen as a practical activity.

Gedenryd (1998: 123) divides inquiring action into two kinds: exploration and experimentation. Exploration „is much of what an infant does when he explores the world around him, what an artist does when he juxtaposes colours to see what effect they make, and what a newcomer does when he wanders around a strange neighbourhood. It is also what a scientist does when he first encounters and probes a strange substance to see how it will respond.“ (Schön 1983: 145) The author interprets the quotation to be intended as gender neutral.

In her successful courses on learning methods for students at ETH Zurich and in her book on Explorative Learning, Verena Steiner (2000) also makes a point for the integration of thinking and doing. She thereby uses the theories and findings by Ned Herrmann (1999) who investigated the preferred styles of thinking in his large-scale research projects.

Steiner (2000: 17) characterises people who learn in an explorative way as based on curiosity as their frame of mind. They use observation and reflection as basic skills. Their interest is further focused on content as well as processes. She describes explorative learners as reflecting on the learning processes, which has some parallels to Schön's (1963) reflective practitioner.

The basic structure of Steiner's (2000: 101) learning process is a cycle consisting of

- 1) setting a goal and collecting information followed by
- 2) thinking and planning,
- 3) doing and controlling,
- 4) observation and reflection.

All four sub-processes are iterative while the whole process is iterative as well. While this process structure applies to work processes in general the more specific process structure for explorative learning is described by Steiner (2000: 129) as a cycle consisting of

- 1) setting a goal and activation of available knowledge followed by
- 2) elaboration and reduction
- 3) structuring and storage
- 4) repetition and reproduction.

Again, these are iterative sub-processes within an iterative overall process. Like the design process described by Gedenryd (1998) the learning process by Steiner (2000) is described as non-linear, non-predictable, multi-tasking, having mutual dependencies, changing speed, sometimes reversing direction and different scale. It is interesting to see that applied cognition is described in similar ways in different disciplines and contexts. Some of the earlier work by Herrmann (1989) that has certainly facilitated the development of these views of the thinking process is described below in this text.

An example for an exploratory design process is reported by Gedenryd (1998: 125). It has originally been described by Guindon et al. (1987). The subject is an elevator control system and in the design process a scenario is used. While an elevator is a relatively simple artifact today it would be hard to master the design task without exploration and iteration. Scenario-based design, contextual design and personas are tools and techniques that similarly aim at mastering the fuzzy complexity of real-life problems and therefore became widely appreciated in the interaction design community (e.g. Carroll 1995; Holtzblatt & Beyer 1993; Cooper 1999).

Experimentation is more powerful than exploration. In fact, exploration can be seen as a limited version of experimentation that lacks certain elements of the ‚full‘ process. By making experiments you physically test your ideas in the world. (Gedenryd 1998: 126)

Dewey's original purpose with his theory of inquiry was to explain the role of experimentation in science. It was the experimental method that had made physicists capable of their monumental advances ever since the Enlightenment. Gedenryd (1998: 130) argues that it was also the ancient Greeks' resorting to mere speculation that had made their progress in the natural sciences so marginal, especially in relation to their contributions in immaterial domains - philosophy and so forth

- by the use of the same method. According to Gedenryd (1998), thought experiments were the single method used in Aristotelian physics.

However, Gedenryd misses the point that philosophy and physics have the same roots, like mathematics and informatics do. So blaming philosophy for not making experiments is a flawed argument since nowadays an empirical inquiry is not philosophy by definition. Up to the times of Newton's (1687) *Philosophiae Naturalis Principia Mathematica*, physics was considered as a part of philosophy, namely nature's philosophy. What still remains true is the absence of the experimental method at the ancient Greeks' times. The phenomenon that for many centuries thinking was far ahead of technology, while today the capacities of our tools seem to have surpassed by far our capacities in thinking is a different issue which does not fit within the scope of this text.

These reflections conclude the chapter on the relationship between theory and practice. In the following chapter we will have a closer look at the relationship between different disciplines in design education.

Interdisciplinarity

As already quoted earlier Lawson (1997: 4) states that „design education in the form we know it today is a relatively recent phenomenon.“

This does not only apply to educating design but also most of the design disciplines have only a very short history to build on.

Gedenryd (1998: 1) lists the design domains as architecture, industrial design, graphic design, interaction design and information design.

While architecture is known as a discipline for thousands of years, the disciplines of graphic design and industrial design have been established during the last one or two centenaries, while interaction design and information design became established in the last few decades only. This is reflected in the career paths of more than half of the interviewees in this study. As table 1.1 and 1.2 show there is a high degree of interdisciplinarity in the career of these interviewees. Seven of them do not work in the field in which they received their education. Even one of the interviewees who remained in their original discipline, Günter Domenig, reports about considerable problems in his education and first work experience, more precisely that he often was unhappy with his education or job. See also the first chapter for the remaining parts of his c.v.

1.306 Domenig It was planned that I should not study at a university but start working immediately after leaving the five-years programme at the college (HTL). But I wanted to study architecture and did so. The time at the engineering college was a thoroughly bad experience for me, in the sense that it did not provide any general knowledge. I still suffer today of this lack of broad knowledge. The technical college is very much focused on real problems. But general knowledge is an important basis for multi-dimensional work. So as I said, I started to study architecture because of my strong wish and my graphic talent which was always very useful for me. When I came to the university it was still not a long time since the end of World War II. So the education there had certain weaknesses and flaws. It did not provide any broad training in the complex field of architecture, instead it was quite narrow-minded. There was no international information on architecture available. So this training was quite poor as well. Today these flaws have been overcome. After my school education in Carinthia and my university study in Graz, I wanted to work with architects

Original Disciplines		Target Disciplines			Original Disciplines		
	Architecture	Product Design	Interaction and Media Design	Electronic Music	Literature, Drama, Film	Informatics	Medicine
Günter Domenig	ox						
Pelle Ehn			x ←-----		-----o		
Andreas Gruber	ox						
Joseph Gründler				x ←-----	-----o		
Gerhard Heufler	o -----→	x					
Urs Hirschberg	ox						
Orhan Kipcak	o -----→		x ←-----		-----o		
Rob van Kranenburg			x ←-----		-----o		
Fiona Raby	o -----→	x					
Michael Szyszkowitz	ox						
John Zimmerman			x ←-----		-----o		

Table 16: Interdisciplinary moves of interviewees. It is interesting to note that a majority (seven) of the interviewed design teachers have a strong interdisciplinary approach in their work or even show a major change in discipline in their biography (arrows). The diagram shows how the disciplines are interrelated. / o = original discipline, background / x = field of current activity

who integrate certain positive dissonances in their work. So I moved to Vienna, Austria, and my first job at an architect's office was a deception for me. Later I worked for other more interesting architects. Then I started my office in Graz and became a lecturer and a professor at the university.

There may be two reasons why many design educators have a non-linear career path: First design education, especially in the field of new media, has a very short history, and so most of the programmes running today have not been available at the time the interviewees received their own education. Second the interdisciplinary work and divergent thinking are certainly more inherent to design than to most other disciplines. This is characteristic for but certainly not limited to the so-called creative disciplines like architecture and media design. Also people who have a degree in physics also quite often do an interdisciplinary shift in their career. One of the interviewees, Joseph Gründler, even moved from medicine to music. Both physics and medicine are disciplines who do not suffer from a lack of job opportunities or low income. So these career shifts are caused by strong interest in the new discipline. Also the author and the supervisor of this text have included design thinking and design practice into their work while this has not been an important part of their professional education.

Another interesting interdisciplinary career path is reported by John Zimmerman. (See also the first chapter for the remaining parts of his c.v.)

1.410 Zimmerman I have an undergraduate degree in history followed by a background in film, video and multimedia production. Then I received a masters degree in Interaction Design from Carnegie Mellon University in Pittsburgh and that's my last schooling. I spent five years as a multimedia designer at the Media Design Centre at Carnegie Mellon which was very much project-based work, from two-week projects to multi-year projects. I did a variety of things, from industrial videos to high-end TV commercials, interactive CD's, websites - some very narrative-based, some very content-based, some very transactional-based. And that professional experience was excellent for me, teaching me how to make things that are actually in use. What's the level of craft that's needed to make something that somebody really wants to use, depending on the amount of time you have, budgets, appropriateness. After my time in multi-media production I did four years of industrial research at Philips Electronics and what that really gave me was an excellent methodology for research. How to ask interesting questions, how to search for knowledge in a design space, which I think is a fairly difficult and unexplored area. I don't think design has a strong tradition of research that produces knowledge other than just producing artefacts, which are harder to get, guidelines and rules out of, and I think the balance of my experiences, one much more product-focused and one much more research-focused, help me give a very balanced model to my students. - I also did some improvisational acting as a part-time activity, a separate creative release when I was a multimedia designer. That was definitely good training, just thinking on your feet, how to instantly react, and it actually made me very successful in the multi-media product design because generally we had to go out and pitch our services for a contract. It quickly became one of my jobs because I became very good at the pitch. I had to get the money, to get someone to commit to spending money to make something. - Before becoming a faculty member at Carnegie Mellon I have been with Philips for four years and before that with Carnegie Mellon for five years. Before that again I did a couple of years of film-making as a solo freelance. And before that then I was an undergrad. So I've spent a long number of years at Carnegie Mellon.

This interesting example by Zimmerman shows that interdisciplinary skills can be very valuable, especially if it is not common to have these skills as a combination. However, it is an important challenge for schools and universities to maintain interdisciplinary study programs as the organisational

complexity gets very high and not every combination of skills and knowledge may be considered as sensible.

A recent report suggested a solution to all this would be to educate students in the different design disciplines all through some kind of common university degree only allowing specialisation later (Bill 1990). However, „such an idea, while well meaning, is fundamentally flawed. (...) Very few students apply to study more than one design field. Thus although architecture and product design seem very closely related there is little contact between the fields.“ (Lawson 1997: 6)

At one hand it seems that even disciplines that are relatively close to each other have fundamental differences and even difficulties in talking to each other, as reported by Lawson:

„Although some architecture and some product designs look very close it is really the extreme end of the bow of the architecture tree rubbing up against a leaf at the extremity of the product design tree. We tend to think that they are very similar, but they are not. Fundamentally their roots are completely different.“ (Richard Seymour in: Lawson 1994; Lawson 1997: 6)

Lawson concludes that the choice of a professional direction which leads to specialism starts already early at school, especially encouraged by the British school system which only allows students to choose a few subjects.

At the other hand Lawson states that while very few designers are trained in more than one field, many creative masterpieces or inventions have been done by people who had not been specifically trained to work in the field in which they made their contribution (Clegg 1969; Lawson 1997: 7). So it was a musician who invented the Kodachrome films and a sculptor who invented the ball-point pen.

Lawson concludes that a design should not be classified by its end product, while this error is frequently done as a reflection of our increasingly specialised technologies. „Specialisation, however, can easily become a strait-jacket for designers, directing their mental processes towards a predefined goal“ (Lawson 1997: 8).

This is reflected in a category of jokes on professionals who interpret the problems they see according to the point of view typical for their profession. Like the proverb says, „if you own a hammer every problem tends to look like a nail.“

The field of interaction design has to deal with similar problems than the ones described by Lawson. However it is a much younger discipline with a lot of non-formally trained people or people with different educational backgrounds working in the field. This leads to a generally much more open-minded approach towards interdisciplinary thinking.

On the other hand interaction design is maybe even more technology-driven than architectural design, town planning or product design. For this reason not much of a common sense has developed in the discipline, and if there is any it is due to the efforts of a few well-known individuals or gurus like Donald Norman, Ben Shneiderman and Jakob Nielsen.

Lawson (1997: 10) points out that the vast majority of the artefacts we design are created for particular groups of users. Designers must understand something of the nature of these users and their needs whether it be in terms of the ergonomics of chairs or the semiotics of graphics. Along with a recognition that the design process itself should be studied, design education has more recently included material from the behavioural and social sciences. Yet designers are no more social scientists than they are artists or technologists.

Lawson (1997: 10) states that the designer cannot escape the influences of three very broad categories of intellectual endeavour, namely science, art and technology. He concludes that one of the essential difficulties and fascinations of designing is the need to embrace so many different kinds of thought and knowledge. Scientists may be able to do their job perfectly without even the faintest notion of how artists think, and artists for their part certainly do not depend upon scientific method. For designers life is not so simple, they must appreciate the nature of both art and science and in addition they must be able to design!

When technological, scientific or social development makes it possible that a new discipline emerges it first has to go through a process of professionalisation. This is reflected in the creation of university programs and professional societies. It can also be accompanied by concurrence between more traditional fields who like to consider the new field as a part of their own, as long as the new field still does not have enough size or impact to hold its own. As long as a new discipline has not gone through this process, people working in this discipline will be considered as interdisciplinary or have to make their career without formal training or with a training that does not exactly match their needs. Also one can argue that before a person can really do interdisciplinary work he or she has to be formally trained and experienced in at least one discipline.

Lawson describes the development of professions. „Approximately one in ten of the population of Great Britain may now be described as engaged upon a professional occupation. Most of the professions as we know them now are relatively recent phenomena and only really began to grow to the current proportions during the nineteenth century.“ (Elliott 1972; Lawson 1997: 21)

According to Lawson the whole process of professionalisation led to the creation of a professional élite.

„(...) there are still those today who argue that the legal barriers erected between designer and builder are not conducive to good architecture. In recent years the RIBA (Royal Institute of British Architects) has relaxed many of its earlier rules and now allows members to be directors of building firms, to advertise and generally behave in a more commercial manner than was originally required by the code of conduct. Professionalism, however, was in reality not concerned with design or the design process but rather with the search for status and control, and this can be seen amongst the design-based and non-design-based professions alike. Undoubtedly this control has led to increasingly higher standards of education and examination, but whether it has led to better practice is a more open question.“ (Lawson 1997, p.22)

Obviously universities and schools have an important role in the definition and creation of disciplines and professions. Within a school this task is mainly done by those lecturers who are active in more than one discipline. So after this general discussion on the role of disciplines and links between them we now take a look again on what the interviewees say in this issue.

5.100 Question 21 Do you establish links to other disciplines in your lectures or seminars?

We can start with an interesting conclusion which has been a rare event in this study, namely a unanimous statement. The value of links to other disciplines is emphasised by all eleven interviewees. It is the first unanimous statement that has been found in this study so far.

If we look at the answers in detail we see that there are, however, different reasons and approaches towards this interdisciplinarity. We start with the most clear and short statements.

5.101 Gruber Yes.

5.111 Szyszkowitz Yes I do.

5.102 *Kipcak* Yes, constantly.

5.110 *Zimmerman* Yes, and I wish it was even more so.

Domenig starts with giving some examples of the involved disciplines.

5.106 *Domenig* Yes, I establish links to the theory of architecture, to science and to other disciplines that go beyond (architecture).

First Heufler explains how other disciplines play a role in the projects at his school.

5.109 *Heufler* Yes we do especially in project work. Therefore when there is co-operation with the industry, when – for example – a new cable car has to be developed, then co-operation with marketing is established, partly also with innovation management or similar disciplines.

interdisciplinarity

YES ☒ Dom, Ehn, Gru, Grü, Heu, Hir, Kip, Kra, Raby, Szy, Zim (all)

disciplines

informatics	Gru
music	Gru, Szy
all creative disciplines	Kip
creative writing, literature	Kip, Szy
film directing	Kip, Zim
engineering	Kip
science (biotechnology)	Raby
social science	Zim
design (for engineering students)	Zim
mathematics, physics, psychology, electronics	Grü
art, culture, fashion, architecture, technology	Heu



Table 17: Unanimous agreement on interdisciplinarity in design education.

Later in his interview Heufler makes a more general statement and comes back to the issue of interdisciplinary influences.

8.609 *Heufler* In design one must look permanently left and right, forwards and behind. Cultural influences or influences from art, from architecture, also technical innovations influence us.

5.108 *Gründler* Yes a lot.

After having contributed only gives a very short statement first, later in a different context Gründler comes back to this issue as well.

8.608 *Gründler* There are trends like for example digital audio technology. I teach the communication chain from sender to recipient, from a musician to the perception phenomena. You need to know all related aspects if you like to build a system.

Van Kranenburg is the first one to add a limiting factor to interdisciplinary co-operation.

5.103 *Kranenburg* Yes, I am very open to other disciplines. However it should not be done too early. People have to build a sense for their own discipline first.

Hirschberg elaborates on the interdisciplinary nature of architecture.

5.107 *Hirschberg* Definitely, I find this very important. As stated, in some cases what we do here has only a limited relevance to architecture. It does have a lot to do with architecture but not really building projects, because connections to other areas are sought. - *KB: So it is primarily a mixture between architecture and new media?* - *Hirschberg:* New media, yes. To me architecture is the epitome of a multidisciplinary discipline. And in this sense there are no subjects that do not fit, but to which and how? At the Institute of Artistic Design we can benefit from the connections from the artistic side, but we also have the informatics department next door, where we sometimes invite guests to our lectures; the computer scientists are also next door. At Harvard I worked very intensively with a psychologist. We often invite people to the final crits and sometimes to give lectures, too.

Pelle Ehn gives some examples of interdisciplinary workshops at the School of Arts and Communication at Malmö University.

5.104 *Ehn* As I mentioned before, we have interdisciplinary workshops. For instance we just had a PhD course in interaction design which we called the „identity course“. Each of the eight students participating was finding a text which could be an interaction design text, like it could for instance be Tuni dance thesis hursing tales, or it could be Lev Manovich new media (Manovich, online), related to their own background, e.g. as a set designer would look at this from the basis of set design, or someone else would look into collaborative work, like the work of Bruno

Latour on agency and ANT networks. In interaction design we're focused on trying to get closer to the core of this. It is from the outset extremely interdisciplinary, with a background in product design, graphic design, human-computer interaction, computer-supported collaborative work, participatory design, architecture, media studies, art, media theory. So from the beginning it is a very interdisciplinary field. One of the big efforts is to try to find a core within this. At the same time, for the interaction design students, they would also be explored to media studies or cultural studies etcetera.

A detailed case study comes again from Fiona Raby. She explains how at the Royal College of Art she and Tony Dunne bring students of different disciplines in contact to each other.

5.105 Raby Yes, we do this. It is very hard to do it formally, because in architecture the projects are for a whole year. So there is one project and it takes a year. Tony's students who are in product design, they do smaller projects, maybe two or three projects a term, and they can be radically different, from the design of chairs or the kind of exploding a product to storytelling, the topics can be completely different. So it is really hard to fit the two, but obviously we are a partnership and we know the people in interaction design. What we did this year and what we try to do is to make events informally. I know my students' work, Tony (Dunne) knows his students' work, and we say that we should get them to meet. So we set up the thing that at the beginning of the term we get them all to meet in a bar and we went around and said, you are going to meet him. We had to introduce them, because they are all shy. All the product designers sat there and all the architects but they are too shy to talk to each other, so we had to mix them all up. So they know each other and they know the studios, and we informally get together so that they know the people then to make informal networks themselves. I think that helps to get exposed to others.

After that Fiona Raby reports about the RCA's yearly public show.

5.105 Raby Besides the connection between the disciplines architecture, product design, and interaction design, there is also a similar thing in the college. It is a very small college and we have an event called work in progress, where all the departments have to show work in progress. This is a really brilliant event. In the main space which is usually rented out and costs a fortune, they make a point of all the students who are doing a public show. It is really interesting because all the students have to make decisions about their work and display in a public space, and they get to communicate to other departments, so for example you can meet a ceramicist. You tend to attract

students who meet other students in that way, so they may be interested in their work, they may start to chat to each other, and lots of relationships happen that way. You find students informally mix a lot between the different departments. What is really nice is that they get exposed to other peoples' work, and they get exposed to other expectations, so they can start to (work together). I must admit that for architecture students it is very difficult in an art college, because everybody is making things - and they are only drawing and thinking, which is really odd, that they can't make anything.

Finally Raby talks about her most recent and most interdisciplinary project which establishes a link between design and biotechnology, two disciplines that are not really close to each other indeed.

4.405 Raby We always talk about the way of working is a kind of ginipigs. They are doing experiments together. We don't always know what the outcome is going to be. Like we decided to make a film one term, to see what happens. We test the ideas that we are thinking about. In our own practice at the moment we become obsessed by biotechnology. One of the research questions in our own research was, how can design play a role in the bioethics debate? Can it raise awareness by making things tangible, can it actually help people to see alternative futures? So we thought, we are going to make this hypothesis, let's try it. We do this project every year in interaction design, and at the time we are working with Irene (Mavrommati). So we asked her, can we do biotechnology in interaction design, does that count? She was very open and said, let's try it. So we did an experiment with students. There was a four-week project, hardly any time, exposed them to lots of research that we have found, just to see what they do, because we had no idea what would happen, whether they would find it interesting, whether they could come up with some design proposals or whatever. And we had group discussions again, and we would go away and do the same thing. Obviously, in only four weeks there is very little you can do, but that was an experiment. We used the word research we were doing, to try to understand something we were doing, but equally they were learning from us about the value systems that we had in place.

5.200 Question 22 If yes, to which ones and by what means?

While this has already been answered by some of the interviewees before, the guideline insisted on the question asking about details of these co-operations. It has to be noted that Gruber and Gründler, while working in very different disciplines, have their offices in the same building. They know

each other and some of the links between architecture and music is probably based on the personal contact between these two educators.

5.201 *Gruber* Mainly to informatics, but also to music.

5.208 *Gründler* Electronic music is related to mathematics, physics and perception psychology. These are the disciplines I want to connect.

Besides Gruber and Gründler also Szyszkowitz who is teaching in Braunschweig, Germany, describes the link between architectural design and music in an interesting way.

5.211 *Szyszkowitz* To literature: Sometimes you need to get inspired by reading a book which is related to a certain mood or atmosphere. Or music: Music plays a very important role in architecture, because rooms and spaces have also acoustic characteristics: The wind blows across a hole in the wall, or the wind slams a door. A room needs to support human sound and must not impose limitations to the users with respect to sound they may produce.

Raby elaborates on her example on the biotechnology-design co-operation which she introduced in the section above.

5.205 *Raby* There was also interdisciplinarity in our project about biotechnology. What was really interesting was that we (the tutors) did not do this, but they (the students) would come to us and say, can you do that with DNA, and we said, we don't know, but there is a college over there called Imperial College, go and find somebody. And what was amazing is, they did. And when we had the crit, the final presentation, there was a particle scientist sitting in the audience to whom one of the students had gone to ask how something worked, and a bioethicist and a material scientist from the Imperial College who came into the RCA this year. For the crits he is going to help us because he found the whole thing we did particularly interesting. It was really nice that there was this relationship between Imperial College and what we were doing at the RCA.

The connections to social science and film are presented by Zimmerman. He also points out that there are differences in teaching the same discipline to students with different backgrounds - an issue which will be dealt with in the next chapter.

5.210 *Zimmerman* Generally when I teach, for one of the semesters I teach visual interaction design to design students only. And there, almost all my readings are social science readings because I think those are the most powerful inputs to the designers. There's some technology readings too,

but there are certainly no design readings, because these students already know, how to design things. What they don't know is how to incorporate the knowledge, or find the knowledge of the social sciences, what are the human behavioural rules, how do they apply those in design. What technology is available that they can incorporate in design, if they don't know how to find that, so my exposure to them is to try to teach them to do this on their own. It's quite challenging because the design students are unlikely to read. My other semester I teach computer scientists and behavioural scientists and have almost no designers in that class. So for those students they get a lot more design readings; grid, color theory, very traditional graphic design, information design readings. So it depends on the class but yes I try to mix these three fields together. Where I feel I'm really lacking is some sort of business input and I'd like to find some more business-focused case studies that I think would be appropriate for my students, I just haven't got there yet.

5.210 Zimmerman Also I use examples from film but I throw those into design. (Laughs.) Since I have a film background I have a million anecdotes from film, and it's something I love and I'm very passionate about. It's easy for me to draw analogy from that, but I've also found that my students are fairly film literate as long as I stick to examples in the last few years and it's a good way of explaining complex concepts to them if you can find film examples.

Besides Zimmerman also Kipcak uses film as a way to teach design. I like to conclude this chapter with Kipcak's statement which is like the ultimate conclusion in the issue of interdisciplinarity.

5.202 Kipcak All creative disciplines are interrelated and have a similarity based on the psychology of the creative process which is similar for creative writing or product design or media design. It is necessary to show this parallel aspect in education, this is why I invite film directors or architects in my seminars. Sometimes creative thinking can even be seen in engineering disciplines, and this can lead to very interesting and dynamic cooperations.

This statement leads us directly into the next chapter which explores the ways of teaching creative design skills, and whether educators even have a right to claim that they can teach their students to become creative.

Teaching creative design skills

In this chapter I like to explore the ways of teaching creative design skills. Like in user-centred design, at the beginning we have to focus on the students as the „consumers“ of the teaching service we offer, and at their specific needs. Lawson conducted some research in order to find out about the design process.

Lawson (1972, 1979, 1997) describes a laboratory experiment conducted with two groups of people: Architecture students and post-graduate science students. The task was a simplified design task involving approximately 6000 solution possibilities, an explicit design goal and hidden design rules. „While the scientists focused their attention on understanding the underlying rules, the architects were obsessed with achieving the desired result. Thus we might describe the scientists as having a problem-focused strategy and the architects as having a solution-focused strategy.“ (Lawson 1997: 42)

Lawson (1997) concludes that it looks like the cognitive style of architects and scientists is consistently different. When he repeated the experiments with school pupils and first-year architecture students he found no difference and concluded that the way of thinking is determined by the people's educational experience rather than by some inherent cognitive style.

I am not totally convinced by Lawson's conclusion since his experiment did not compare first-year students of science (e.g. physics) to first-year students of architecture or design. I believe that a preferred style of thinking is already there at the age of 18 and that this contributes to the individual choice of the discipline in higher education. Especially students of e.g. physics or chemistry according to my experience do have other problem solving strategies than the average student. I believe that this issue could be worth further investigation.

„Architects are taught through a series of design studies and receive criticism about the solution they come up with rather than the method. They are not asked to understand problems or analyse situations. (...) By comparison scientists are taught theoretically. (...) Psychologists, in particular, because of the rather ‚soft‘ nature of their science are taught to be very careful indeed over their methodology.“ (Lawson 1997: 42)

These differences in the preferred style of thinking and problem solving have been analysed in large research projects in the 1980s by Ned Herrmann (1989). His research with thousands of employees in industry led him to the creation of a simplified model of thinking styles built on four quadrants. While these quadrants have an analogy to four physical parts of the brain, I believe that the value of this model is not in the description of the physiological process of thinking which is probably not totally correct. However, Herrmann's model turned out to provide a viable model in practice to understand the relationship between different preferences of thinking with the requirements of certain jobs and professions. Also the question is addressed of how much our preferred thinking style leads us to choose our discipline or profession, or whether our thinking in turn is influenced by our job.

Herrmann's model has been taken over by many practice-oriented writers on creativity, on management, and on learning, like e.g. Verena Steiner quoted earlier in this text. Besides Herrmann other researchers tried to find out more on the thinking process of designers.

„In more realistic experiments, Eastman (1970) and Akin (1986) found that designers did not separate analysis and synthesis in their way of working, but they were constantly generating new goals and redefining constraints, and found out about their problem as they critically evaluated their own solutions.“ (Lawson 1997)

The limitations of laboratory experiments led Lawson (1997) to conducting interviews with designers. The flaw of this method is that it is dependent on the designers telling the truth. On the other hand the advantage is that he could interview some very good and experienced designers whereas experiments are usually carried out on students only.

Some interviews with well-known British designers carried out by Jane Darke (1978) showed that faced with a complex design problem they tended to start with a relatively simple idea which she called „primary generator“ and visualised in the following process model:

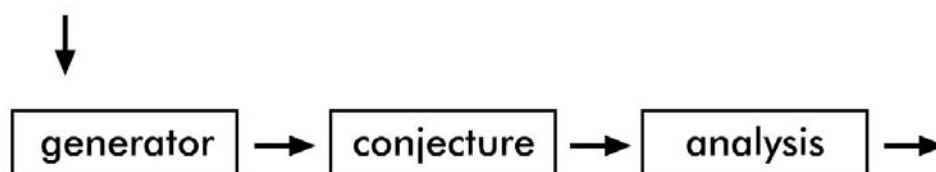


Figure 20: Primary generator process model

„In plain language, first decide what you think might be an important aspect of the problem, develop a crude design on this basis and then examine it to see what else you can discover about the problem.“ (Lawson 1997: 45)

Similarly, Rowe (1987) in his research of design drawings detects a primary generator instead of a problem analysis. He found out that designers have a tendency to stick to their initial ideas even if they encounter considerable problems, e.g. like in Jorn Utzon's famous Sydney opera house. This only makes sense for really great ideas, however. (Lawson 1997: 46)

Also Lawson (1997) states that „clients often seem to find it easier to communicate their wishes by reacting to and criticising a proposed design, than by trying to draw up an abstract comprehensive performance specification.“

Lawson (1997) concludes that the idea of a design process as a sequence of activities is rather unconvincing and questionable. „It seems more likely that design is a process in which problem and solution emerge together. Often the problem may not even be fully understood without some acceptable solution to illustrate it.“ As a consequence Lawson comes up with a visualisation of the design process seen as a negotiation between problem and solution through the three activities of analysis, synthesis and evaluation.

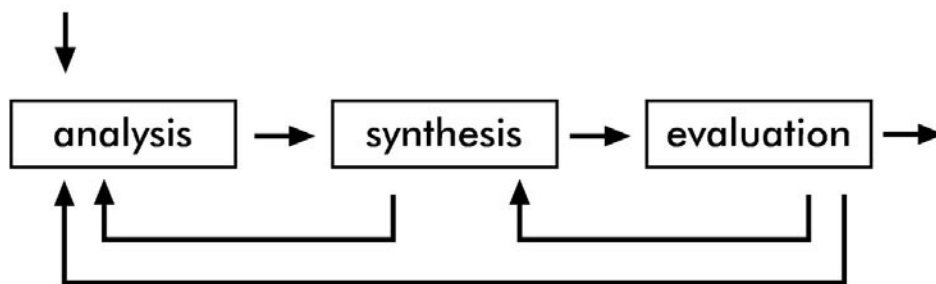


Figure 21: Design process model according to Lawson

While these models help us to understand the design process, it is still not so much documented in literature how the creative process can be taught most effectively. The interviewees of this study expressed the following opinions to this issue that are summarised in the tables below.

Role of students' creativity

<input checked="" type="checkbox"/>	Very important.	Gru
<input checked="" type="checkbox"/>	Important if expression of personal contribution.	Szy
<input checked="" type="checkbox"/>	Most important, but as a service function.	Heu
<input checked="" type="checkbox"/>	Helpful. Not a myth. Some even need to limit it.	Kip
<input checked="" type="checkbox"/>	Important, but not in terms of originality.	Kra, Hir
<input checked="" type="checkbox"/>	Depends on students' background.	Zim
<input checked="" type="checkbox"/>	I do not like the creativity hype.	Grü
<input checked="" type="checkbox"/>	Creativity is hopelessly over-rated.	Kra

Use of creativity techniques or methods in work or teaching:

<input checked="" type="checkbox"/>	Yes, the teaching methods described earlier.	Hir
<input checked="" type="checkbox"/>	Yes: Interpretative skills exercise, express a notion in different media. E.g. analyse the colours of a plant - find a complete colour concept.	Szy
<input checked="" type="checkbox"/>	Yes: Learning by doing.	Szy
	(In different context:)	Gru
	Circular hand-over of projects or presentations.	Gru, Kra, Raby
<input checked="" type="checkbox"/>	Yes. It applies to every discipline, e.g. mathematics, informatics. It is inherent, not separate.	Grü, Zim
<input checked="" type="checkbox"/>	Yes: Do fieldwork; put yourself in the position of the user.	Zim
<input checked="" type="checkbox"/>	Yes: Brainstorming, morphological box, analogy building.	Heu
<input checked="" type="checkbox"/>	A little bit: Mock-ups, design games, enacted prototyping sessions, video sketches, six hats.	Ehn
<input checked="" type="checkbox"/>	No, I hate brainstorming; but maybe sitting and talking, discussion of findings. Hand-over of presentations.	Raby
<input checked="" type="checkbox"/>	No creativity techniques, please! These exercises exercise pressure.	Kip

What is the role of creative design in your teaching?

<input checked="" type="checkbox"/>	Utopian dreams, concepts and visions are very important for students. They set your targets.	Dom
<input checked="" type="checkbox"/>	It is incredibly important /	
<input checked="" type="checkbox"/>	essential /	
<input checked="" type="checkbox"/>	very important.	Raby, Heu, Hir
<input checked="" type="checkbox"/>	I do more concept creation than design.	Gru
<input checked="" type="checkbox"/>	It is not very important.	Grü
<input checked="" type="checkbox"/>	Every process can be subject to design.	
	All my teaching is about design.	
	It is not art but daily business.	Kip

(To what degree) can creative design skills be learned or taught?

What about talent?

(1)

<input checked="" type="checkbox"/>	Yes. Design skills can be acquired like any other skill. It is not mainly a gift. Talented students can save some time, but nearly everything can be learned.	Gru
<input checked="" type="checkbox"/>	Yes it can. Students mainly need to learn to make value judgements. It takes some two years. Some have a creative sparkle. Each person has a very different kind of creativity. I don't know how important talent is. Sometimes an incredibly talented student does not move further, while sometimes the best students do terrible things first but constantly learn.	Raby
<input checked="" type="checkbox"/>	It can be learned to a high degree. Talent: Some create music, others create concepts.	Grü
<input checked="" type="checkbox"/>	We can teach to find new things at the intersection of disciplines. This is instrumental. You cannot require creative acts from students. There is a false dichotomy between creative and non-creative. A pure job education is not enough, like in polytechnics or e-learning.	Kra

Table 18: Position towards creativity in teaching design















Can creative design skills be learned or taught? What about talent?		(2)
<input checked="" type="checkbox"/>	We have not really solved this. It depends a lot on the background and selection of students.	Ehn 
<input checked="" type="checkbox"/>	Talent is quite important, but one can learn a lot by practicing and from others. It is helpful for students to compare their abilities with others.	Hir 
<input checked="" type="checkbox"/>	We can teach a lot of basic skills (functionality, usability, creative writing, dramaturgic setting). However, exceptional talent is rare and cannot be learned. Sometimes inconspicuous students after one year create exceptional things.	Kip 
<input checked="" type="checkbox"/>	Everyone can do creative concepts, only some in visual design. We should focus on our strengths and expertise.	Zim 
<input checked="" type="checkbox"/>	There are both extremely talented students and the ones who learn it from scratch. To be open-minded and hard-working can lead to equal or even better results than pure talent. Laziness is certainly a talent-killer, and this will never change. Better they change the job.	Szy 
<input checked="" type="checkbox"/>	It is difficult to teach. It can be developed further but some creative potential must exist.	Heu 
<input checked="" type="checkbox"/>	I can not teach dimensions of art to anybody. Talent for art is rather inherited. In a sense, design skills can be taught, but everybody has a personal, individual language which can only be respected, supported and developed.	Dom 
What methods can be used to teach design skills?		
	Learning by doing; trial and error. No theoretical analysis of others' work. Simple exercises, e.g. solving a problem in many different media.	Gru 
	Study literature and architecture. Work a lot under pressure. Intensive individual supervision.	Kip 
	See what others don't. Filter data appropriately. Use traditional skills. Use textual, visual and corporal literacies. No new gadgets, but services. No information overflow.	Kra 
	"Crits" or critique sessions. Study exemplary cases. Practice. (D.Schön, L.Wittgenstein) Projects with different lengths.	Ehn 
	Getting experience. Working with an experienced designer. Receiving critique on own work. This is a long process. Only motivated and obsessive people will succeed.	
	Discuss examples from good and bad design in lectures. Discuss students' work.	Hir 
	Patchwork of different aspects of art, design and technology. Make them converge later. Use structure and methods. Do not rely on intuition.	Heu 
	Take different positions, adopt roles, compare results, find own position and identity. There are many ways to teach design skills.	Szy 

Table 19: Position towards creativity in teaching design

6.100 *Question 23* *What role does creativity of students play in your teaching?*

The interview guideline provided a series of questions to this topic in order to explore the role of creativity in design education carefully and from several points of view. In reply to the first question Gründler and van Kranenburg had a rather critical view of creativity.

6.108 *Gründler* There is a creativity hype for the moment which I do not like. Also creativity is not easy to define.

6.103 *Kranenburg* Creativity is important, but not in terms of originality. Most of the problems come from people mistaking creativity for originality. In our completely connected world, originality is no longer possible, and it is no longer interesting as well: it is a 19th century concept. But all the students want to be original. So this is the first thing I try to get out, to take out of them. Creativity does not mean that you have to create something new.

On the other hand the remaining six interviewees assigned an important role to students' creativity in design education. Gruber and Kipcak also emphasise that students' creativity has some positive influence back on the teacher.

6.101 *Gruber* Creativity plays a very important role. We try to develop it and it is interesting and fun for all to see the results.

6.102 *Kipcak* It is much easier to work with people who show a certain response and sparkles of talent. When the students are interested the teacher will perform better, too.

Heufler has a pragmatic view on creativity which is in line with the pragmatic, industry-focused philosophy of his successful degree programme in Industrial Design.

6.109 *Heufler* Creativity is definitely the most important thing. But it should not be creativity in a purely artistic sense, in the sense of self-realisation, but in this case it is principally a service function as a problem solver, therefore creativity must be subordinate to this.

Hirschberg explains the challenges that come with the implementation of the open co-operation within large student groups that he uses in his seminars.

6.107 *Hirschberg* Obviously a big one. In Graz there is always a discussion with the art rooms and the students learn a lot together. I am a great believer in this function, this interchange between

the students, and I try hard to promote it. In the classical situation, as I experienced it, it was also frowned upon at the same time, to take on things that others have made. It is sometimes also a huge stress factor that (a student) always sees what the others are doing, but one must hold one's ground and is not allowed to do the same. I try to turn this factor off a little because I do not think it promotes creativity; the students are allowed to use the work of others because I always try to find further uses in the next exercises. It is then openly declared "I am now working with this and I am going to develop it." Every student is able to see what the other student has added. I think that through this the relationship to creativity is interesting, copying 1:1 is obviously not creative, but to develop something that someone else has created contributes a lot to the development of creativity. Therefore the taking over of ideas and being creative oneself is not a contradiction for me, but something that supplements mutually. This is something that I really believe in and try to implement in my teachings.

Zimmerman points out that the question of creativity seems to be specific for the first two years of studying a creative discipline.

6.110 Zimmerman That's a very difficult question because the students also all express - depending on their training - they all express their creativity in different ways. For the design students, by the time I see them they are in their third or fourth year, they generally have a strong sense of themselves, and a strong sense of their own explorative method, so I don't generally have to push them too hard, to push the creative envelope. In some cases it's more like pulling them back to the practical part, trying to keep that tension there, how do you find that balance.

Finally Szyszkowitz places creativity at the centre of a design educator's job.

6.111 Szyszkowitz Of course creativity is important. It is my job to support and provoke students' creativity. I need to get the students to start thinking on their own. It would be easy to see a beautiful thing and to copy it. They need to add something of their own thinking, of their own personality to the situation.

6.200 Question 24/25 Do you appreciate methods for enhancing creativity in your own work? / If yes, what methods do you appreciate or use?

The idea of using creativity methods or techniques was rejected by Kipcak and Raby. As Kipcak points out these methods may make sense for certain people who are not that creative out of their own. In fact creativity techniques usually are promoted within non-design disciplines like project management.

6.202 *Kipcak* Creativity should not become a strange myth. We should rather try to limit creativity, so you should reverse the question. Toscanini was an eruptive musician and personality, so he preached self-limitation which was necessary for him. Others may need a creativity technique, but this depends on the individual conditions. - No creativity techniques, please!

6.205 *Raby* Yes, we do certain things together for different focus, but not brainstorming ideas, because actually I am very much against that. That is why we have this thing called round tables. I don't know if you can discuss anything unless you come with some previous background material. I think, to do brainstorming, you need to go away, come back with some evidence, and then we can discuss what you found, and then we can discuss what the implications of what you found is. It has to be based with some background stuff. You can't do brainstorm with just empty your heads onto a sheet and (say) „what have we got now?“

The other interviewees who answered this question actually agreed with using creativity methods. However, some of them probably interpreted the term creativity methods in a broader way.

6.211 *Szyszkowitz* Yes I do.

6.207 *Hirschberg* Yes. I think one can actually see what I do as a method to enhance creativity and I have discussed it as a creativity technique.

6.210 *Zimmerman* There are a couple of methods that I use. One is I try to give my students a little taste of improvisation, so it's a type of acting where you have to become a different person in a different situation. So you are a person, you have relationships and you are somewhere and get them to use this as a way of experientially becoming users, use it as a way of very rapidly producing design ideas. The other thing that I do to try to increase creativity, or more to direct it, is: I require field-work, so whatever product they are designing for they have to go and find users in the real world doing real things. I think that's a great place to spark creative ideas, to get out of the classroom.

Gründler points out that creativity is not limited to the so-called creative disciplines.

6.208 *Gründler* Yes I like to support creativity. But somebody who finds a new algorithm is creative as well. It cannot only be expressed in painting. I like to encourage leaving one's own usual position and do something different, and this is a creativity technique.

Heufler at the other hand definitely understands the term creativity techniques in the same way that is often used in management literature to describe methods like e.g. brainstorming, and he agrees with applying some of these.

6.209 *Heufler* Definitely. This is repeatedly done by us and it is also an element of our lectures. - It starts with the classic brainstorming. There is the morphological box, analogy building. Those are the most important. Complex methods are pointed out such as synectics etc., they are hardly used by us.

6.300 *Question 26* *Is it possible to use creativity techniques in design-related lectures or seminars? Do you do this?*

Like in the question before Kipcak and Raby make it very clear that their position towards creativity techniques is a critical one. On the other hand Raby proposes to interpret a workshop she does in the sense it is seen as a creativity technique.

6.302 *Kipcak* No. I am and have always been against these exercises stimulating group dynamic and emotions, and the pressure exerted by these gurus.

6.305 *Raby* No, I hate brainstorms, partly because it is such a sweat coming up with ideas and it takes such a long time going away and you spend ages crafting and going away and finding things. The one session in Syros was good because we spent five days sitting and talking - that was pretty intense (comment by author: creative session in small group with Alan Munro and John Darzentas in 2002 at the University of the Aegean, Greece). But otherwise it's very light level. But one thing we do is, when they bring a drawing in, we have this workshop, we mix up all the students and someone else has to present someone else's work. This is very good because they have to do it from the little bit of information they have got - because communication is really poor - that is quite entertaining and quite fun. So there is a few little things we do. It is usually just about communication and how to communicate to somebody else. But not in the early stages to try to

think and to come up with ideas, because development of ideas takes a long time. It can take a term to actually get hold of and develop a hypothesis.

Gründler takes a neutral position.

6.308 *Gründler* I did not consider it in detail so far.

On the other hand there are some clearly positive replies by the following five interviewees listed below.

6.307 *Hirschberg* Definitely, I do.

6.309 *Heufler* Yes they are used in the lectures. These methods are used in the idea identification phase and in the concept phase.

Ehn reports about some „general“ and some design-specific, or more precisely some interaction-design-specific methods he uses.

6.304 *Ehn* We do a little bit of creativity methods, especially our focus would be on working with mock-ups, design games, enacted prototyping sessions, we recently started with video sketches like Wendy Mackay developed, which is quite useful. These are typical techniques but we also use traditional methods like the six hats etcetera.

As his example of creativity techniques Gruber presents the very interesting exercise I called project handover. This method appears in modified versions in the interviews by Gruber, Raby, and van Kranenburg. For me identifying this method as a specific one for design education is one of the highlights of this study. The method is described in more detail in the chapter on education methods and in the summary.

6.301 *Gruber* The most important teaching method is learning by doing. - A good training method for design is the circular handover of projects. An exercise is divided in e.g. eight steps, like in the following example: Creatively fold or crumple up a piece of paper; take pictures of it; make sketches of it; find spaces in it; make a 3D simulation of it; etcetera. After every step the results are presented and every student has to choose a different piece of work to continue with. - A simpler method similar to the circular handover of project says that every student has to present somebody else's work. As communication is usually bad, this is a funny experience which leads peo-

ple to an understanding of how important it is to communicate the own design approach properly to colleagues, management or customers.

Another interesting type of exercise where students have to express a notion in different media is described by Szyszkowitz.

6.311 Szyszkowitz In my basic design seminars I use exercises to teach interpretative skills, like the following topics: „interior and exterior“, „black and white“, „heavy and lightweight“. How can you express the notion of „heavy“ or the opposite „lightweight“? How do you deal with a junction of different materials? Or how do you show a „movement in space“? Every student will generate a drawing, or a three-dimensional mockup, or a videotape. This will initiate reflection on these phenomena, or on the properties of space. All students have to use the same media, so we will be able to compare the results and the students will be able to learn from each other.

It is valuable to compare the methods of teaching creative design skills to the creative design process used or described by experienced designers. According to Lawson the primary generator is central to this process. This is one of the outcomes of his interview-based study published in 1994 and used as well in his book „How Designers Think“ (1997).

„Characteristically designers become strongly committed to the ‚central idea‘ or ‚primary generator‘ which gives them strength and energy in case they get stuck or bored in the design process.“ (Lawson 1994; 1997: 160)

„The architect Richard MacCormac argues that a high quality design relies on a holistic approach which does not separate the phases for outline and detailed design.“ (Lawson 1994; 1997: 197)

Agabani (1980) reports of a study where architecture students were shown a design brief and a video-recording of the building site. After that the students were themselves recorded as they discussed the problem. In this example some students started with declaring mistakenly that a medium-importance requirement would be ‚the most important thing‘. Lawson (1997: 202) concludes that making sound judgements on the importance of constraints is a central skill for good designers.

Another procedure is characteristic for the design process, namely „(...) the early phases of design are often characterised by what we might call analysis through synthesis.“ (Lawson 1997: 203)

Of course there are individual differences between designers as it is not a standardised process.

„Some designers only shift attention when they come to a dead end, while others seem to deal with several ideas in parallel (...).“ (Lawson 1997: 204).

Let us remember the notion of tame and wicked problems introduced in the first chapter of this text. „Part of the art of dealing with wicked problems is in the act of not knowing too early which type of solution to apply.“ (Rittel & Webber 1973; Lawson 1997: 205)

Creative thinking has been made popular by writers and scientists like de Bono (1967) who calls it ‚lateral thinking‘. He proposed the methods of wearing different coloured hats to play the role of different characters (de Bono 1991). This method has been mentioned above by Ehn. „Techniques such as brainstorming and synectics rely on the assumption that a group of people are not likely all to approach a problem in the same way, and that if the natural variety of the individuals can be harnessed the group may be more productive.“ (Lawson 1997: 206)

However as Lawson concludes, published ‚design methods‘ usually are „not full methods for designing but techniques for controlling the direction of thought. So long as the reader does not expect too much from these mental tools and is prepared to adapt them they may well prove useful. (...) there is very little evidence that professional designers find such things practically useful. However, underlying many of these mental tricks are a relatively small number of fundamental principles which can also be observed in the design process of successful designers.“ (Lawson 1997: 206)

As I know from my own teaching experience it often happens that students ask for standard design methods. The expression is somehow exaggerated but students sometimes imagine a design method being something like a cooking recipe. It is clear that such a method does not exist, while the literature on creativity techniques mainly written for management trainings does suggest the existence of such wonder methods. In design education we definitely need to coach our students in a way that they take one step back and focus on the right level of the problem.

The good design tutor is careful to draw the student’s attention to the need to think afresh about the problem without preconceptions about the type of solution. (Lawson 1997: 207)

The following case study reported by Lawson comes from the Netherlands where several interesting didactical approaches, like e.g. problem-based learning, have been developed.

When the Open University began a course entitled ‚Man-Made Futures‘ the course team saw the need to provide this kind of help for students who would not necessarily have the normal levels

of contact with their tutors. Perhaps for this reason, Reg Talbot and Robin Jacques invented PIG, or the problem identification game. The game itself is probably rather too elaborate to be a useful design tool in practice, but the ideas behind it are extremely valuable. The idea of PIG is that the designer distils the problem down to a very short and simple statement from which crucially problematic relationships can be identified. These relationships or 'problem pairs' as the game's authors call them, can then be used to try to develop others and thus expand the understanding of the problem. Five mental tricks are used: asking the designer to think of ways of relating people or issues by 'conflict', 'contradiction', 'complication', 'chance' and 'similarity'. Thus the game might proceed by identifying people involved in the design situation as being in conflict or seeing things from different points of view (contradiction), or seeing that things may not be as simple as originally thought (complication). (Lawson 1997: 207)

A programme of design methods proposed by Geoffrey Broadbent (1973) distinguishes between the following methods: (Lawson 1997: 208)

- 1) „*Pragmatic design* is simply the use of available materials and methods of construction, generally without innovation, as if selecting from a catalogue.
- 2) *Iconic design* is even more conservative in that it effectively calls for the designer to copy existing solutions.
- 3) *Canonic design* relies on the use of rules such as planning grids, proportioning systems and the like, e.g. Le Corbusier's 'Modulor'.
- 4) *Analogical design* results from the designer using analogies with other fields or contexts, like the use of organic forms.“

Another use of analogy is made by the method of 'narrative design' or design by story-telling that has also become popular with architects, while it is of course inherent to set design and advertising. „In some cases the architect may tell a story about the 'characters' who form the users of the building and the 'roles' they play and the 'rituals' in which they are set. At this level architecture almost becomes a kind of real-world theatrical set.“ (Lawson 1997: 211)

Lawson states that story-telling is powerful and flexible as a design technique. „The telling of stories within a design practice about the emerging design solution seems a relatively common technique (...) (that) also seems to help cement the design team together around this shared but slightly private world.“ (Lawson 1997: 213)

As I mentioned earlier in the case-study on problem-based learning in the chapter on education methods, I regularly use to teach personas, scenarios and storytelling as a technique in my seminars. Personas have been introduced to interaction design by Alan Cooper. Personas became popular in interaction design rather quickly as they help to overcome some of the problems that often are in the way of finding a good user interface solution. In this way they can be considered as a creativity technique.

In his book „The Inmates are Running the Asylum“, Cooper (1999: 123ff) introduced the notion of personas to HCI. Originally a persona is a virtual person appearing in a theatre play or in a movie. When designing a user interface, Alan Cooper suggests defining user personas, i.e. virtual persons who represent typical people belonging to the product's target group(s). Information about the target groups is collected before that via interviews, focus groups, etc. One persona is selected, who for some reason is the less skilled one because of age, knowledge or experience. This persona will play the user's role in the UI design process. It is for him or her that the user interface is designed. The reason for using personas and not real users in the design process is primarily that a persona does not have individual properties and needs that any real person has. The persona only has collective, average properties and needs instead. Also the persona is always available and after a while will be well-known by the designers and engineers.

Pivec and Baumann (2003) transferred the idea of personas to e-learning. In the real world university students usually can choose their teachers. In today's e-learning tools, the tool may try to adapt to the student, or the student can set various parameters in order to personalise the tool. The persona concept will make this choice as easy as in an ideal real world situation: Students can select one out of a set of „teacher personas“ that represent various tested and approved teaching and learning styles. This leads both to better usability and to quicker and higher quality adaptation than the other known methods.

Scenarios are short descriptions of a situation of use involving the personas and an artifact that has to be designed. There are some parallels to the discipline of film scripting and screenplay where storyboards are used in the creative process. A storyboard can be considered a graphical version of a scenario. So again, while personas and scenarios are not considered as a creativity technique outside the design area, these methods are definitely a tool used in the design process and therefore qualify as a creativity technique.

6.400 *Question 27* What is the role of creative design („Gestaltung“) in your teaching?

This question includes the German term „Gestaltung“ because it was somehow unclear to me whether my translation would fully do justice to the original meaning of this term. There are three very clear and short positive statements in this issue.

6.405 *Raby* It is incredibly important actually.

6.409 *Heufler* Creativity is essential.

6.407 *Hirschberg* We teach design methods or design – therefore it is very important.

Some balanced statements come from Gruber and Kipcak, while Gründler does not qualify his own teaching as related to creative design.

6.408 *Gründler* Not a lot for the moment.

6.401 *Gruber* In my discipline (note: computer-aided design in architecture) there is more concept creation than design. It is half and half, which is not a lot of design in an architecture context.

6.402 *Kipcak* This depends on how design is defined. You can design a social process which accompanies a piece of work. Every phenomenon dealing with communication can be subject to design. All my teaching is about design, and this is not art but daily business.

Kipcak is certainly right in that the question lacks some more precise definition of creative design or „Gestaltung“ as it was called in the original German interview guideline. Like Kipcak also Zimmerman sees the issue in a broader context and not limited to one or a few specific disciplines.

6.410 *Zimmerman* Yes, well I think the behavioural science students and the computer science students express their creativity in very different ways. They do it in different methods of problem solving, so, it might be a way of coming up with an idea of how to comb something, it might be experimental design and I try to push their strengths in those areas into generating more interesting design solutions. I think that it's in them, it's just not coming out in a way that most designers are trying to see.

Zimmerman's understanding of creativity as a skill inherent in most of us or in everybody's mind but which needs formal training in order to come out is a good explanation of the issue. It is very

much in line with what Herrmann (1989) concluded from his extensive studies mentioned earlier in this text. Domenig, on the other hand, emphasises the notion of utopia in the context of education to creativity.

6.406 *Domenig* (Note: This interview quotation by Domenig has been used twice in this text.) Teaching at the university is done both by real tasks and utopian tasks. I can show you some early utopian projects that we made. In my opinion, utopia is very important for students. They need to work on dreams and visions and explore the limits of theoretical feasibility. It does not always have to be possible to build it. Utopian concepts offer an ideal principle from which I can try to deduct reality. For example a system of support beams has a certain shape and needs to be packable. So these are the things that define the whole architecture and the whole horizontal and vertical traffic within the building. The utopian ideas in your mind are at the basis of that. They set the targets for new dimensions in architecture. How could the form of an artefact be? For example I had an early and visionary idea for a project in Agadir, which defined the shape for a pavilion for the Munich Olympic games in 1972. The association to a utopian vision can give you a guideline on how to work under real conditions.

While Domenig takes utopia as a starting point for his creative process, he then brings back the utopian idea to the level of reality. To cover this wide span between utopia and technical feasibility is probably an essential core competence of a successful designer, no matter whether in architecture or in other design disciplines.

6.500 *Question 28* *Can creative design skills be learned or taught and if yes, to what degree?*

Another view on the same issue is raised here when the whole attempt of teaching creative skills is put into question. The following four interviewees have answered with yes. Gruber's position is that the influence of talent is close to zero, while diligent training and hard work will do it.

6.501 *Gruber* Design skills can be acquired to a high degree. It is not very different from any other technical skill. It is not mainly a gift someone has.

Gründler goes so far as to say that while the students will develop their creativity during the study time, the tutors have more the role of a facilitator in this process.

6.508 *Gründler* I think it can be learned to a high degree. My colleagues and I we do not teach aesthetic principles, but students present their own concepts and the tutors help them to see what are the problems in implementing them. It is not my way to favour students who imitate their teachers.

Van Kranenburg describes creativity with a metaphor as the act of exploring the intersection between two different concepts or disciplines. Indeed it is very fruitful to combine different worlds and concepts can arise that nobody has used before.

6.503 *Kranenburg* This is very difficult, because you have to have a kind of experience for this. Only a few students do understand this. Of course you can teach creativity, because you can draw two sets of things, and you can draw where they meet, and then you can go there and find things. But this is an instrumental kind of creativity, as it has been used now. So you can teach creativity as an instrument, but you cannot require creative acts from your students. Anyway, I think that it is a false dichotomy between creative people and non-creative people.

A lot of interviewees first spontaneously declare that this is a difficult question, namely Kipcak, Ehn, Domenig, Hirschberg, and Heufler. According to Kipcak lots of skills can be taught but the ultimate creative ability is a matter of talent.

6.502 *Kipcak* I would like to know the answer. We can teach some skills in what by our common sense we call functional design or usable design. Exceptional talent is very rare and rooted deeply inside a person. We can teach a lot of skills up to a certain level, but the exceptional can only be available in a person's talent. I have studied film scripting and worked as a journalist. The Vienna Film Academy has a very hands-on approach to creative writing which I appreciated a lot. They are teaching simple tips and tricks like the correct dramaturgic setting of a novel or how to deal with a deadlock situation. I could imagine that teaching similar basic skills in design could help even talented students to avoid many detours.

Like mentioned earlier by Zimmerman (6.110) the crucial time for the development of creativity are the first two years of studying a creative discipline. Ehn's argument below clearly underlines this. Ehn describes an interesting difference in the requirements of art teachers and science teachers. For him this question is still a dilemma.

6.504 Ehn

This is a very good question. The really true answer is that we have not really solved this. At master and PhD level the school is an elite school. The students who come can show and demonstrate by their portfolio that they are able to do creative works and hopefully also have reflective skills. In that sense they already come in as persons that have already demonstrated competence. On the undergraduate level it is different because the way that we have to recruit students is by their marks from school. So those with the highest marks come in and you have no idea what their creative skills are. So it is interesting enough to see that those among the teachers who have an arts background usually want the best, the most creative minds to get in, and their intention is not so much to develop creative competence. Teachers who have an academic background usually are a little bit different, they rather want students who have a potential to develop. So it is not a straightforward answer. We are aware of the dilemma. On master and PhD level we deliberately choose to engage people who have demonstrated to have both a creative and a reflective competence, whereas - in our interaction design programme which is like an HCI programme with a little bit more design - on undergraduate level we do not expect them to have „Gestaltungs“ skills (design skills), but many of them have. For example there is a student, Per, who went to our undergraduate programme and before that he had lived as a poet for fifteen years and this skill really comes through in what he is doing now.

Hirschberg states that talent is important, but students can learn a lot by practicing and from others. It is helpful for students to compare their abilities with other students.

6.507 Hirschberg

This is a very difficult question. I follow the approach, on the one hand, to prepare relatively structured contents and to let the students work on them, on the other hand, not in the sense of how it is perhaps done at high school: to show everyone how it is done and they must replicate. The student must find out for himself if he or she has a talent for it or not. We just contribute in a supportive way to the discovery of individual talent. In this sense there are certainly people who do not have creative talent, but realise faster that they do not have this talent by way of exchange - among other things - with the other students, which I find very important. Apart from this, one can naturally learn a great deal from the others and I think that principally there is no exception to this on the creative side. This is also something that one can cultivate or improve by experience, practice, looking at examples of others. I would not go as far as saying that talent is not important, also here a lot happens through exercise and practice. I think that the role of this "green

house” is that one can realise what the others are able to do and also what one is personally not able to do.

A very similar statement is made by Zimmerman who proposes that everybody should know his or her strengths and focus on them.

6.510 Zimmerman What I would say is: I think everyone can be very creative especially at the concept phase. But I think visualising something, rendering something, actually giving a form to something takes many, many years to craft and to focus the creativity to get a good solution quickly. I’m not saying it’s impossible to teach the more technically focused students that, but I think it’s irrelevant to teach them that, because making that investment takes them away from their expertise. So focus on getting them being creative in the concept phase, not necessarily in the craft of design.

According to Raby creative design is linked to the ability to do value judgements, i.e. critically evaluate their own work and the work of others.

6.505 Raby That is what takes a year to do, because we are dealing with a set of values, and that is why it has to be completely iterative, where they need to try different understandings. If they don’t come up with a really interesting hypothesis, if they don’t understand; we all keep working on a hypothesis until we get something that is worth working out, is worth taking further steps, something we desperately want to know, so that kind of goal is the one of the most important things. Sometimes that is why the research phase just continues on, because they are still developing and trying to understand. I think it almost takes two years before you get really good students to understand those kinds of value judgements, because that is what they are making: They are making value judgements.

Szyszkowitz’ statement has many parallels with what has been said before. He points out that there is a danger inherent to talent.

6.511 Szyszkowitz There are both extremes, the extremely talented students and the ones who learn it from scratch. You can achieve a good results with both extremes. The ones who learn a lot will also learn that they have some hidden talent which they can use. They learn to become more self-confident and to listen to their intuition. Suddenly they will get a profile, based on the fact that they have learned their lessons. On the other hand there are the talented people, the geniuses,

there are some really astonishing talents. But sometimes, they can get to their limits, because they believe they know everything and do not need to learn any more. Then they will lose the track and the others who are less talented but open-minded and hard-working will equal them. The ability to learn and to stay open-minded is also a kind of talent.

Heufler and Domenig express a more critical statement regarding the training of creative design skills. They both believe that only existing talent can be increased and developed.

6.509 Heufler Very good question, it is difficult to teach. One can develop existing talents and give them possibilities. But to learn them – some come to us and say they want to learn this here, we have to disappoint them. The creative potential must exist and this has to be developed.

6.506 Domenig This is not easy to answer. I believe that talent for art is rather inherited. I cannot teach dimensions of art to anybody. I can only tell the students what they should try out themselves, and that they should look for their own way. I always had the best feeling when I designed an artefact or a building which corresponded to my nature, in which I project my personality, when my abilities directly turned into architecture and so I completely identified with it. Well, in a sense, design skills can be taught, but there is a danger in it. Everybody has his or her own way of designing. So I cannot impose a design principle to somebody which does not correspond to his or her personality. That is why I say: Everybody who is interested in and talented for design has his or her language. This can be supported and developed, but only when you respect the individuality of the person.

Like in our interview study there have been different theories of thinking as summarised by Lawson.

First, the behaviourists believed that human intelligence comprises only one basic process, the formation of associations. (Lawson 1997: 133)

Second, the Gestalt school of psychology established a tradition of studying problem-solving. Their theories of thinking concentrate on processes and organisation rather than mechanisms. They paid particular attention to the way we represent the external world inside our head as a mental image they called ‚schema‘. Bartlett (1932, 1958) showed that drawings could be remembered better if they were meaningful. Human thought processes develop in parallel with basic schemata. (Lawson 1997: 135)

That people with a certain education see things in a particular way is a consequence of education and training. This can lead to the well-known phenomena that whole disciplines lose the contact to their customers or users.

„I have for many years tried to teach first year architectural students to remember how they ‚see‘ architecture before they develop the sophisticated concepts which architects use to debate subjects. A real problem for designers is that they have so many more concepts or schemata for describing the objects they design that they genuinely do ‚see‘ them differently to those for whom they design. This can easily lead to a result known as ‚architects‘ architecture‘, which can only be appreciated and enjoyed by other architects!“ (Lawson 1997: 136)

Phenomena like the one described above are not specific to architecture. They exist, and maybe in an even more problematic form, in scientific and technical disciplines as well. Most often new technical products created by technicians are only suitable for other technicians. They are gadgets bought by early adopters of technology. The whole discipline of usability engineering emerged because of this situation.

Third, the cognitive science approach to thinking appears to bridge the gap between the behaviourist and the Gestalt theories. They concentrate on mechanisms while still viewing thinking as a strategic skill. Garner (1962) made experiments in short-term memory, discrimination, pattern perception, and language and concept formation all using information theory in order to measure human performance. (Lawson 1997: 136)

As Lawson points out, reasoning and imagining are probably the most important to designers:

- 1) Reasoning is considered purposive and directed towards a particular conclusion. It is held to include logic, problem-solving and concept formation. (Lawson 1997)
- 2) When ‚imagining‘, on the other hand, the individual is said to draw from his or her own experience, combining material in a relatively unstructured and perhaps aimless way. Artistic and creative thought as well as daydreaming are normally considered imaginative. (Lawson 1997: 140)

„Problem-solving obviously requires more attention to the demands of the external world than to inner mental needs. In imaginative thinking, on the other hand, the individual is primarily concerned with satisfying inner needs through cognitive activity which may be quite unrelated to the

real world. (...) Design is directed towards solving a real-world problem while art is largely self-motivated and centres on the expression of inner thoughts.“ (Lawson 1997: 141)

„Designers must consciously direct their thought processes towards a particular specified end, although they may deliberately use undirected thought at times. Artists, however, are quite at liberty to follow the natural direction of their minds or to control and change the direction of their thinking as they see fit.“ (Lawson 1997: 143)

Bartlett (1958) suggests to distinguish between ‚thinking in closed systems‘ and ‚adventurous thinking‘. The ensemble of elements in design problems is usually neither entirely closed nor entirely open. In literature there is often a division between two categories of thinking:

Convergent, rational or logical thinking, typically requiring deductive and interpolative skills, measured by conventional IQ test problems and associated with ability in science. (Lawson 1997)

Divergent, intuitive or imaginative thinking, an open-ended approach, measured by (mistakenly so-called) creativity tests and associated with skill in the arts. (Lawson 1997)

These two concepts have frequently been oversimplified and variously confused with intelligence and creativity. Obviously, design taken as a whole is a divergent task. However, as Lawson (1997: 146) points out, there are likely to be many steps in any design process which themselves pose convergent tasks.

In order to solve design problems the ability to do „problem setting“ is central, i.e. to generate design solutions and simultaneously redefine the problem can only be learned by working on practical examples under supervision of an experienced tutor.

Bryan Lawson’s experiments he carried out with students of architecture and other disciplines gave insight to this issue. His experiments preceded his own series of interviews with architects and designers. Like in his interviews he tried to find out in his experiments „how designers think“ and whether there are specific properties of the design process used in practice. In Lawson’s first experiment he assigned the same design problem to three groups of architecture students and found out that every group started the design process with a completely different „primary generator“. This starting point influenced the whole rest of the design process.

A second experiment made by Lawson (1997) explored the issue of different thinking styles specific for the discipline or field. He conducted the experiment with students of architecture and students of science. They were given a simplified design task involving 6000 solution possibilities, an explicit design goal and hidden design rules. It became evident that the scientists focused their attention on understanding the rules: They have a problem-focused strategy. On the other hand the architects focused their attention on achieving the result: They have a solution-focused strategy. It can be concluded that the cognitive style of architects and scientists is consistently different. Also he showed that there is no difference between school pupils and first-year architecture students. Lawson concluded that the way of thinking is determined by the people's educational experience rather than by some inherent cognitive style.

When comparing Lawson's study with the findings by the highly interdisciplinary American researcher Ned Herrmann (1989) I believe there would be room for more in-depth consideration of this issue. Herrmann's findings have already been applied to education by himself and e.g. by Verena Steiner (2000). The essence of his work on styles of thinking says that both the experience and individual conditions contribute to a person's preferred way of thinking. Certainly the thinking style also has an influence on the choice of a certain profession, or on the acceptance of a person at the entrance exam of a university or school. The question how much the education will shape a person or - on the other hand - how many of the people with a certain personality will go for the same profession maybe deserves further consideration.

6.600 Question 29 If yes, what methods can be used to learn or teach design skills (principles of design, practical work, feedback from experienced designers, exercises, study of the works of others)?

Gruber gives clear priority to practical exercises over theoretical study.

6.601 Gruber The best method is always learning by doing, or trial and error. Theoretical analysis of others' work is not so good.

6.603 Kranenburg For example the full course of Bauhaus exercises by Johannes Itten that every student had to take. They were trying to create a part of the work and find a Gestalt.

Kipcak places interdisciplinarity in the centre of teaching methods. In later private conversations Kipcak emphasised the value of the Bauhaus basic course of design also mentioned by van Kranenburg above. These exercises are used in education at Graz Technical University as well. They include for example the systematic analysis and decomposition of a classical work of art.

6.602 *Kipcak* Myself I have learned most from studying literature and architecture. Literature offered me a theoretical verbal instrument and helped me to see things from a distance. Architecture requires structured distributed parallel processes and gave me a relationship to common sense.

Szyszkowitz again is in favour of the method where the imitation of others' work plays a central role.

6.611 *Szyszkowitz* As I described earlier you need to think in a different way, independent of the mainstream. You need to get the right atmosphere. Also you can try to see the task with the eyes of an important figure in earlier architecture: How would Le Corbusier do this, what would Scharoun do, Mies van der Rohe, or a simple builder from the countryside? By adopting these roles and comparing them you also start to understand your own position: Who are you, what role do you play in this context? It is a process of finding your own way.

In the following detailed statement Ehn mentions the value of critique sessions that are discussed in more detail in the chapter on grading and evaluation. In contrast to Gruber but in line with Szyszkowitz he also assigns some value to traditional methods like the analysis and imitation of earlier work. He also reports that his institute tries to use different lengths of projects.

6.604 *Ehn* I think the most important and effective method which we do not normally have in universities but you do have it in art and design schools, that is the „crits“, the critique sessions. You do a piece of work individually or collectively and you get a critique of this work in a dialogue. You start to learn a bit of the language of critiques which I find fundamental to develop these kinds of skills. It is not so much following the master what he or she is doing, but it is more like doing something and then you have a skilled professional teacher and your co-students and then you find ways to learn from these critique sessions. That is the most important method for developing these skills. Then of course there are methods like the traditional methods of imitating others, and this is of course offered to you. Our design philosophy is very much in line with Donald

Schön or Wittgenstein, the idea of presenting the students with a set or repertoire of exemplary cases which they can relate their own work to. And when they have done their own work, then to start to practice and develop the language of being familiar with the critique.

6.604 *Ehn* We do this in master and PhD level only, because there the group size is 16 people maximum, so it works fine. On undergraduate level this is not possible. - The feedback on undergraduate level is group feedback, group assessment of the projects. - There, we will also talk about the design quality of the project. That will be part of it but it will also be more like a group process. - On master or PhD level we would typically have them to work in groups of two, three or four, and present their work in an exhibition-like format. Their professor and usually an external expert who comes in would then critique on that. - These critiques are typically after each project and some time in between, so once or twice a month. Projects are in different sizes, in the beginning there were four week projects but now we try to experiment with projects between three days and eight weeks. We started to use different lengths of projects to explore different qualities and problems in the project work. We just change it that way. The ideal at the moment is to work with different project lengths. There are many things you can do in a very short project, but you will not be able to implement anything. In a very short project you can sketch and demonstrate in a short project, but you only can implement something in a longer project. - There could be a course in parallel to a project, but normally we do project after project.

Like before Raby emphasises the training of value judgements. She sees a good way of training in a master-apprentice situation.

6.605 *Raby* Making value judgements is something you can only teach by experience. I did it in three years with Keiichi Irie in Japan. The RCA has a very different way of teaching. I learned through working in Keiichi's office for two years closely, the decisions he made, the things he did. He was so inspirational, I learned so much from him. I think that is what you meant by atelier process of learning through experiencing somebody else making decisions and a set of value judgements. And obviously I would produce things and he would critique on what I produced.

Hirschberg describes the method of critique of students' work in a lecture situation.

6.607 *Hirschberg* One naturally shows the works of others in the lectures, whereby I seldom show something to be the only direction, but make the use of good work from students and show

what is good and what is not so good. This work is very project-orientated, where it is not clear from the beginning what the ideal end result would be. That would not seem to me to be adequate for the university situation.

Heufler calls his way of teaching a patchwork philosophy and describes the interdisciplinary element of it.

6.609 *Heufler* In the first year of study we try, with a type of "patchwork philosophy", to work through the different aspects of design in individual facets, in single building blocks that stretch from artistic to technical, in order to focus on them in second year project work, and to lead to a mutual goal from all the different areas.

Like stated above by Gründler (6.208) creativity is not limited to the so-called creative or design disciplines. As well, Czikszentmihaly's (1997) study on creativity includes innovators of all disciplines from art to science.

„While design is usually considered as one of the most creative human pursuits, creativity and creative thought can be applied just as much in science, medicine, philosophy, the law, management and many other fields of human endeavour.“ (Lawson 1997: 148)

„The creative process is described by famous artists in different ways, partly as a very easy process, partly as a considerable effort.“ (Lawson 1997: 151)

The easy feeling during the creative process has parallels to the flow experience described by Mihaly Czikszentmihalyi (1990) in the analysis of an interview-based study. He found out that the phenomenon he called flow was described by many successful and creative people from different disciplines. Like Herrmann's (1989) work also Czikszentmihalyi's flow experience was also used for innovation in the area of management training and continuous education e.g. by Felix von Cube (1997, 1998).

A five stage model of the creative process by Kneller (1965) is: first insight / preparation (conscious) / incubation (unconscious) / illumination / verification (Kneller 1965)

Santiago Calatrava points out the need for a specific problem in design: „It is the answer to a particular problem that makes the work of the engineer. (...) I can no longer design just a pillar or an arch, you know I need a very precise problem, you need a place.“ (Lawson 1994)

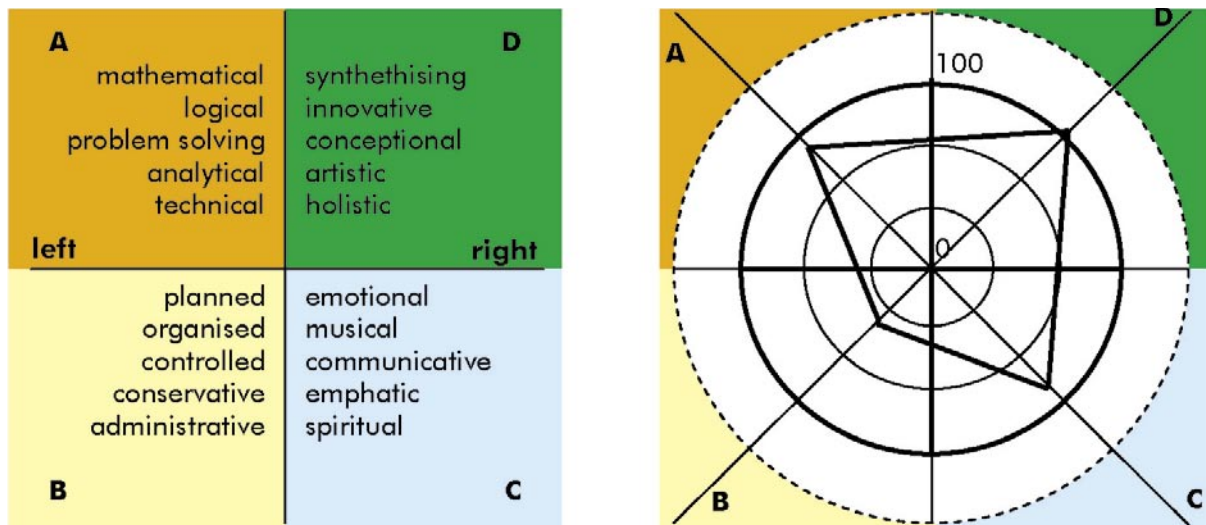


Figure 22: Styles of thinking, adapted from Ned Herrmann: The Creative Brain (1988)

An important role in the work of a designer is played by external constraints. As Heufler pointed out it is easier to design a building for a narrow space in a city centre than for an empty green field.

Designers „are most creative when the problem is imposed upon them from outside. This might seem in conflict with some recently fashionable views on design education that students should be given free and open situations in order to develop their creativity.“ (Lawson 1997: 152)

We earlier discussed the issue of whether creative skills are a matter of talent or whether they can be acquired like any other skill. In this study the issue was seen in different ways by the interviewees.

Lawson also raised „the question as to whether or not some people are naturally more creative than others.“ (Lawson 1997: 155)

A study by Roe (1952) showed that creative scientists were characteristically very intelligent, but also persistent, highly motivated, self-sufficient, confident and assertive. Mackinnon (1976) found creative architects to be characteristically poised and confident, not especially sociable, intelligent, self-centred, outspoken and aggressive.

„Disturbingly it was the group of architects judged as less creative who saw themselves as more responsible and having a greater sympathetic concern for others.“ (Lawson 1997: 155)

Compared with Herrmann (1990) this does not seem disturbing but natural. On Herrmann's four quadrant model of the preferred ways of thinking, creative and empathic preferences are in different

quadrants. The remaining two quadrants are for logic intelligence usually measured in intelligence tests and the preference of thinking in structures and order.

The typical intelligence test question asks the subject to find a correct answer, usually through logical thought, whereas the creativity test question is more likely to have many acceptable answers. (Lawson 1997: 155)

Getzels and Jackson (1962) found that the so-called ‚intelligent‘ children at school were seen by their teachers as „conforming and compliant and tending to seek the approval of their elders, while the so-called ‚creative‘ children were more independent and tended to set their own standards. The so-called ‚creative‘ children were less well liked by their teachers than the ‚intelligent‘ children.“

This compares well to the findings by Herrmann (1990) who has shown that the executives of large companies tend to hire people who have a similar thinking preference than they have. Similarly, it is likely that the so-called ‚intelligent‘ children are more likely to become teachers themselves than the so-called ‚creative‘ teachers. This would completely explain the findings by Getzels and Jackson.

Hudson (1968) shows that „science is no more a matter of purely convergent production than the arts are exclusively a matter of divergent thought. So we see that both convergent and divergent thought are needed by both scientists and artists, while it is probably the designer who needs the two skills in the most equal proportions.“

As Heufler and Gruber have pointed out during their interview it is not the degree of artistic quality and originality in the work of a designer but the interdisciplinary and balanced approach and a high sense of realism that are his or her core competences.

„The famous architect Herman Hertzberger points out that it is not creativity if you propose a solution while you just forget about several important constraints that are conflicting with your solution.“ (Lawson 1997: 157)

„The product designer Richard Seymour considers good design results from ‚the unexpectedly relevant solution not wackiness parading as originality‘ (Lawson 1994). The famous architect Robert Venturi has said, for a designer, ‚it is better to be good than to be original‘.“ (Lawson 1994)

As van Kranenburg has described with the metaphor of the intersection of different lines of thought, a novel approach can often be generated by integrating two or more approaches. This will happen

most often if a designer can use knowledge or experience from different disciplines.

„Design is often a matter of integration.“ (Lawson 1997)

As an analysis of one's preferred way of thinking with methods like the HDI by Herrmann (1998) can show, not everybody will be able and willing to fulfil these requirements. This is important to consider in our time where design and architecture have a high factor of „coolness“ and therefore are attractive to an increasing number of high school graduates.

„Those who prefer a more ordered and certain world may find themselves uncomfortable in the creative three-dimensional design fields. Characteristically designers seem to cope with this lack of resolution in two main ways: by the generation of alternatives and by using ‚parallel lines of thought‘.“ (Lawson 1997: 158)

A consequence of the run on design schools is the necessity of access limits. On the other hand it can be difficult to recognise the potential to be a good designer beforehand. This question will be discussed in a separate chapter.

„Creative thinkers in general and designers in particular seem to have the ability to change the direction of their thinking thus generating more ideas.“ (Lawson 1997: 158)

After their in-depth analysis of creativity researchers like Czikszentmihalyi and Lawson today still come to the conclusion that the ultimate answer to the most relevant question for a design educator can not be given so far.

„Are we creative because we are born that way, or are we creative because we have learnt to be? We simply do not have a reliable answer to such a question.“ (Lawson 1997)

In my interviews, however, I still did not resign at this point and made another attempt to get more information out of the educators I talked with.

6.700 Question 30 How do you estimate the ratio of acquired skills to individual talent, especially regarding the ability to do creative design?

As with the question before Gruber has a very clear opinion in favour of the dominance of training design skills, while he at least implicitly admits a certain influence of talent this time.

6.701 *Gruber* Talented students save some time when learning, but nearly everything can be learned.

Kipcak has an intuitive approach to the assessment of talent. However, he admits that some unpredictability still remains, which is an argument against access limits.

6.702 *Kipcak* This is a big mystery. I think I can recognize very talented people intuitively. They do not need to present or market themselves actively. But sometimes there are inconspicuous students who after one year suddenly create exceptional things. This is hard to predict.

Van Kranenburg underlines his position of scepticism towards new technologies, which is a valuable position for a user advocate. Also he makes a point for the time of study as a time of free collection of knowledge, constrained by tight study programmes and not too much directed towards a pragmatic industry-related goal.

6.703 *Kranenburg* This is a very difficult discussion. I think with biogenetics and e-learning it will only get worse. In what is called „Fachhochschul-“ education (polytechnics) I don't really believe that anything can be taught very efficiently, because this implies that there is a knowledge gap somewhere which you just have to fill. That is also the problem with e-learning. But you need the problems, the view, and the process.

From Gründler's statement we can conclude that he believes in the notion of talent, since it is an individual factor and Gründler proposes to let every student find his or her individual way.

6.708 *Gründler* Some students are talented in composing music or earcons, others more in developing concepts. We should accept that and not only favour the first group. Every student should justify his or her way and become convincing.

A similar position is expressed by Raby, who contributed a case study which gives a lot of insight into her argument. It is made clear that at the Royal College of Art like probably in good design schools in general there is a lot of tolerance toward students showing their individual strengths and weaknesses and therefore finding their own niche.

6.705 *Raby* Well, obviously there are some people who have a sparkle, but that is why I think it is very one-to-one. Because in many ways each person has a very different kind of creativity. You know, we have, in my students at the moment, some of them are absolute phantastic at energy

and ability to be very creative with the way they describe and communicate, but in fact it would be important that they produce a physical thing. So the whole process is beautifully designed, but the physical thing is terrible, but nobody cares because the quality is in their communication and their engagement. And then you might get someone else who has no intellectual ability at all, but makes the most exquisite thing - and not just that because we don't just make things - and embodied within that, the thinking is there. So there are very different approaches. We have particularly talented students.

6.705 *Raby* You do get the odd one, like a student I have at the moment, who is phantastic, but we are so worried because she has only done like ten drawings in the whole two years. In an architecture school that is unheard of. But her thinking is phantastic, it is very stimulating. And if she does one drawing it is immaculate and so precious. And yes we are panicking a little bit, because the thinking and the quality is excellent, but it is not backed up, well it is, but there is just not enough drawing there. There are all these kinds of inconsistencies. She is more a kind of a literary philosopher. And she has done a phantastic scheme about the suburbs, about people being obsessed with cars and living in car adverts. There is the critical idea of a fake countryside. Because we are living in this condition that the English countryside is not able to sustain itself economically, so it has to become aesthetic. There is this whole idea of paying the farmers to keep their farms looking nice. And she has done this phantastic project on the suburbs, of how you keep them nice. She reads Michel Houellebecq, she is just great (laughs). She is an architect who in an architectural school is supposed to produce a master plan and some sense of about physicality in the architectural material language, there is not any of that, but it's brilliant. There are very different levels.

6.705 *Raby* I don't know how important talent is. There are students who obviously have talent, there are definitely talented students. But I had lots of experiences where students go at different rates. For example a student who was incredibly talented in the beginning, and he did phantastic work at the beginning, but now after two years - I have had him for two years - he is actually not going to submit. He has become dogmatic and he has not moved on in two years or developed some personal (style). While somebody else who did really terrible things - they are the best students actually - the ones who in the beginning start with, I would not (even) say average; and they are learning. They come and have just terrible drawings and ideas, and the next week they come and it is a bit better, and the next week better, and in the end, they did the most phantastic

projects. So I think there are different rates of talent as well and that all people are actually talented. In the end, I feel very privileged in the way that I am allowed to educate. In the two years or the one year that we are with them, we can work out for them how to use the skills they have to make the things they do. We have the luxury because you cannot do this in education in other places. You have thirty, forty or fifty students, you can't see somebody on a one-to-one basis and spend time trying to understand what makes some tick. We are very lucky and privileged in the kind of education that we are allowed to participate in.

Raby reported above that all students have different levels of skill and talent when they start. Also they are learning at different speed, so the results over time are quite unpredictable. Szyszkowitz shares this opinion and detects a main reason for failure.

6.711 Szyszkowitz Basically many people have a kind of talent, but laziness is certainly a talent-killer, which also prevents people from learning. Lazy students will always stay the same, this will never change, you can forget them, but they will always exist. Maybe they are talented for other jobs, maybe they will be successful soccer players.

A different conclusion is drawn by Zimmerman.

6.710 Zimmerman Well there's definitely an importance of talent, I guess my gut feeling would be that someone that has a tremendous amount of talent in some area generally finds it uninteresting when it's too easy for them and does not do well. In people that have some talent and push themselves, generally are happier doing something because the level of challenge is higher and produce better results. In a sense we should all try to be doing things that we like but we are not necessarily really good at.

We can also draw a different conclusion from that. John Zimmerman actually gives an argument for schools of different levels where people with a „tremendous amount of talent“ would also get an appropriate „level of challenge“. In this model people could work in their area of maximum talent without getting bored by the low level of challenge. While this is a theoretical assumption which does not take into account the complexity of this issue, it should lead to better average results indeed.

Heufler has a balanced view on the contribution of talent and diligence, while Hirschberg summarises the probably only uncontested truth in this issue.

6.709 Heufler It can be further developed but a basis must exist.

6.707 Hirschberg Already discussed above – a difficult subject.

6.800 Question 31 *Can you name some examples of how to teach design skills very effectively and efficiently?*

As mentioned earlier there are methods used in basic design courses like the ones developed at the Bauhaus in the early 20th century. I intended to collect some more examples for exercises and approaches from the interviewees. Two straightforward approaches are presented by Hirschberg and Gruber both co-operating in their seminars at Graz Technical University.

6.807 Hirschberg As above, design skills can be very efficiently taught by looking at works of others, especially the students between themselves.

6.801 Gruber We use simple exercises. Students have to solve similar problems in many different media, e.g. by craftsmanship, by computer, by printing, by videotaping.

A systematic approach is advocated by Heufler.

6.809 Heufler Especially in design one can proceed in a structured and methodical way – for example with design methods – show the students that one cannot rely on intuition, but can make progress due to these design methods or often a standstill or block can be worked around by the use of these methods and one can attempt a new approach.

Kipcak emphasises pressure as a general condition for design training. This can be seen as in physical exercises where the human body needs to be challenged in a certain range of heart rate in order to develop further. For design education and other intellectual disciplines the optimum training range is limited by the levels of boredom at the bottom and over-challenge at the top.

6.802 Kipcak Students need to work a lot and under pressure. There needs to be intensive supervision which takes individual talent into account. This is why I prefer a one-to-one dialogue in my seminars which leads to success most quickly.

Van Kranenburg states that the discussion on creativity has to be led differently given today's quick technological change. Later in the chapter on future trends and challenges we will see that most

interviewees principally would agree with such a statement, while on the other hand catching up with latest trends is also recommended.

6.803 Kranenburg This really depends on the definition of creativity. If creativity is to see something that was not there before, or to recognise data where no one has done it before, that is creativity and an interesting thing. The main skill that people have to know nowadays is a skill that gives them an advantage over the others at the edge. It is not to have more filters than the others because this will lead to information overload. If you can create information out of the data noise which is already completely killing us. And when all devices will talk to each other, this will create another amount of overload again. Creativity is hopelessly over-rated. What we need now, is tradition, I am afraid. We need people with (traditional) skills, and a kind of embodied sense of a coming together of all kinds of literacies - textual, visual, and corporal - that inform a relationship with a rich environment. We do not need more things, there are too many in the world already. Designers should not focus on making new things, but on services.

An interesting example method is described by Szyszkowitz who in the same time identifies one of the flaws of traditional education in architecture.

6.811 Szyszkowitz Design skills can be taught in many different ways. For example when you are looking for the colours to use in a design. Many architects have a poor understanding of colours because they are totally focussed on the three-dimensional aspects and at the end they simply paint it. So I tell them: Go out in nature and select one piece of a plant, like a leaf from a tree or a flower. If you analyse this you will find a complete and sound colour concept on it that includes primary and complementary colours: red and green will enhance each other, or black and white need each other to become effective. So this is a method I use to teach design skills, if I understand the question correctly.

Finally Raby declares that maybe the discussion has been starting from a false implicit assumption, namely the training of a designer can take place within a specified study time. Like training in other more complex disciplines it is probably a never ending process.

6.805 Raby I think it is a long process. For me it is something that takes some time. I was talking about this recently actually: When I was a student of architecture, and I don't know whether it has changed now, but nobody takes you seriously as an architect until you are forty.

Nobody expects you to be when you leave college. There is not this thing that when you leave college then you do (architecture). Of course you leave college and you practice and you do architecture, but when you are in an M.A. course, you are learning certain academic intellectual things, you learn certain things about how to build a building, and you learn how the law fits in, you learn about how to get clients. And then you do your first building, and that is a disaster. Then until you get forty, you might then start to do something. And it is not expected of you earlier. So I think it is possible to learn this, but it is a long, long process. Tony (Dunne) was saying, it is this kind of hunger. It is the same in any kind of occupation: (You need) obsessive people, and in the end it is motivation and they succeed.

6.900 Question 32 Can people better learn to design during practical work or in the context of a formal education?

In this final question the few educators who were still not tired of this topic made a clear statement in favour of a formal education at a school or university. As these educators all make their life of teaching at such an institution the answers are probably heavily biased.

6.901 Gruber It is easier to learn as a student, because you are free from time pressure and financial constraints. You can also learn a lot when you work in an architect's office, but it needs to be a good one.

6.902 Kipcak I do not think that design can be learned effectively in an on-the-job situation. In education we need to provide clearly defined topics and train systematic structural thinking, but we do not need to focus on technical procedures.

6.908 Gründler Both. You can learn it by practice, but some theory will help you.

6.909 Heufler The practical work is always in the foreground and the theory is always supplementary to this.

It is interesting to see these statements, but in order to get a more objective view of this issue it would be necessary to make a cross-check by asking at least as many non-educators, both recent graduates and executives or human resource managers who are in charge of hiring formally trained as well as non-trained employees from design disciplines.

Can people learn to design better during practical work or at a school?

Better as a ■ student (free from time and economic pressure).
Also in a good office.

Gru ■

Better as a ■ student than on the job.
(Clearly defined topics, systematic training of thinking.)

Kip ■

■ Both. You can learn it by ■ practice,
but some ■ theory will help you.

Grü ■

■ Practical work is always in the foreground.
■ Theory is always supplementary.

Heu ■

Figure 23: Can people learn to design better during practical work or at a school?

Design methods and the design process

When discussing design methods it is obvious that the discussion starts with a literature review since this issue is backed up extensively by earlier research.

„In the 17th century design has been seen for the first time as a separated activity from doing.“ (Gedenryd 1998: 42)

In their books „How Designers Think“ and „How Designers Work“ Lawson (1984, 1997) and Gedenryd (1998) give an overview on the development of design from its emergence out of craftsmanship until the development of design theories in the second half of the twentieth century.

„After World War II the scientific study of design methods emerged. The works of Christopher Alexander, Notes on the Synthesis of Form (1964) and Jones, Design Methods (1970) stand out from the rest.“ (Gedenryd 1998: 19)

„A design method is a normative scheme that specifies in detail a certain working procedure, the activities to perform, and also a specific order in which the activities should be carried out. It is usually very precise, and the designer is to follow it meticulously. It also covers the design process from beginning to end.“ (Gedenryd 1998: 19)

„Perhaps the most characteristic feature of the literature on design methods is the prevalence of block diagrams, matrices and networks of many kinds that resemble, to varying degrees, the diagrams and calculations that computer programmers use.“ (Jones 1970: 61)

Lawson and Gedenryd unmistakably criticise all these methods. „Having said this much about design methods, there is but one thing to add: They don't work, and they don't work at all.“ (Gedenryd 1998: 59)

As Gedenryd points out even the original advocates of methods for architectural design, Alexander and Jones, documented the failure of design methods and abandoned them already a few years after having published them.

„Forget the whole thing.“ (Alexander 1971) - „There is not much evidence that [design methods] have been used with success, even by their inventors.“ (Jones 1970)

Favourite design methods and design process model (1):

<input checked="" type="checkbox"/>	From cybernetics, constructivism; nonlinear, non-hierarchical, some computer-aided. Training via project hand-over and presentation hand-over methods and exercises.	Gru
<input checked="" type="checkbox"/>	First reduce complexity, then add elegance, functionality, self-descriptiveness plus (only by the best 10% of students) the vital thing that generates design quality. Teacher personality.	Kip
<input checked="" type="checkbox"/>	Iterative design process. Learn to fail and to retry. Don't decide in advance and draw later. Start with field work, set up hypothesis.	Raby
<input checked="" type="checkbox"/>	Always starts with initial drawing or sketch. Then translate it into reality. Solve organisational and functional problems. Select materials. Do not use computers too early.	Dom
<input checked="" type="checkbox"/>	Four phases: Analysis, concept, design, implementation. Feedback loops. (Assoc. German Eng.) / Theory of product language (Offenbach Design School), practical and semantic side.	Heu
<input checked="" type="checkbox"/>	Analogue design process: Concept drawing, small mockup, big mockup, detailed drawing.	
<input checked="" type="checkbox"/>	Digital design process: Interior spaces first, computer-aided design, rendering. Analogue process goes from surface to inside; digital from inside to surface.	Szy
<input checked="" type="checkbox"/>	Yes and no. Waterfall models do not work in practice. Interactive cyclic process. Respect deadlines and deliverables. Reflect on the process. Prototyping. Never ending. Participatory.	Ehn
<input checked="" type="checkbox"/>	No process model. Fieldwork, iterative design, evaluation. Customised process.	Zim
<input checked="" type="checkbox"/>	No specific process model. Emphasis on media transitions, e.g. physical-to-digital. First learn basic skills like sketching, geometry. Teach it in small steps. Realistic settings.	Hir
<input checked="" type="checkbox"/>	No favourite process model. First make concept or design. Implement. Test. Feedback. I do not teach it explicitly.	Grü

Table 20: Design methods and the design process

Also when solving a mathematical problem and even less in design, „there is no phase of pure analysis, as this activity is intermingled with synthesis; nor is analysis alone sufficient to produce a solution.“ (Gedenryd 1998: 60)

By intramental we understand a process entirely taking place within the human mind. In design theory „the problem is the intramental model of rationality. (...) This failure [of design methods] becomes of general interest; design becomes a domain where the underlying model of rationality has been put to use, under highly authentic circumstances, and failed.“ (Gedenryd 1998: 67)

Lawson states that he is mainly interested in the process rather than the end product of design. „Design as we know it in the industrialised world is a relatively recent idea.“ (Lawson 1997: 14)

Lawson compares design that follows a highly self-conscious process to traditional vernacular or craft design. He reports of a student project where architecture students had to work in groups to design a machine to process marbles which had to deliver two, three and four marbles respectively into three plastic cups. Also he reports that the same group of architecture students spontaneously decided to build an igloo and „immediately and without any deliberation switched from the highly self-conscious and introspective mode of thinking encouraged by their project work to a natural unselfconscious action-based approach. (...) They simply got on and built it. In fact these students shared a roughly common image of an igloo in what we might fancifully describe as their collective consciousness.“ (Lawson 1997: 17)

Lawson describes the way in which the design of traditional tools has developed by craftsmen in a procedure often referred to as blacksmith design, and then handed down from generation to generation. He uses the example of a horse-drawn cart described by Sturt 1923. Lawson concludes that the vernacular or craft-based design process served extremely well when the problem remained stable of many years but would fail when people would face new or quickly changing problems.

According to Lawson (1997: 24) the drawing starts to become important at the moment when the roles of a designer and a maker become two separate professions. They can be divided in „design drawings“ (used by the designer him- or herself), „presentation drawings“ (for the customer) and „construction drawings“ (for the craftsman). Donald Schön (1983) describes this process as „having a conversation with the drawing“. Jones (1970) describes the whole process as „design by drawing“.

The advantages of a drawing-based design process are in its speed, liberty and flexibility. However, a drawing will only show the appearance but not necessarily the performance of the object. „Architects could thus design quite new forms of housing never previously constructed once new technology enabled the high-rise block. What they could not necessarily see from their drawings were the social problems which were to appear so obvious years later when these buildings were in use.“ (Lawson 1997: 25)

In his „Notes on the Synthesis of Form“, Christopher Alexander (1964) argued that „we were far too optimistic in expecting anything like satisfactory results from a drawing-board based design process. (...) Alexander proposed a method of structuring design problems that would allow designers to see a graphical representation of the structure of non-visual problems.“ While Alexander’s method was not successful in practice, Lawson (1997: 25) states that his work had an extraordinarily lasting effect on thinking about design method, because there was a common unease shared by designers about the inadequacy of their models of reality.

Unfortunately the new models, which were frequently borrowed from operations research or behaviourist psychology, were to prove just as inadequate and inaccurate as designing by drawing (Daley 1969). The idea emerged to create a design process based on scientific method. „Scientists made explicit not just their results but also their procedures. Their work could be replicated and criticised and their methods were above suspicion.“ (Lawson 1997: 26) Lawson discusses three possible future roles of the designer suggested by Markus (1972):

- ✓ A conservative, non user-centred role, where designers passively await the client’s commission, produce a design and withdraw from the scene.
- ✓ A progressive, user-centred role, where designers are associated directly with user-groups, believing in a decentralised society and dealing with disadvantaged or revolutionary communities.
- ✓ A path in between these two extremes, where designers remain qualified specialists but involve the users of their designs in a participatory process that includes public inquiry, gaming, simulation and CAD.

In the last one we can identify many parallels to the UPA process described later in this section. As reported by Lawson (1970) engineering design can be defined as to search for „the optimum solution to the sum of the true needs of a particular set of circumstances“ (Matchett 1968). Design

disciplines need different skills. Chris Jones (1970) defines design as „to initiate change in man-made things.“

Another design process model offered by the Royal Institute of British Architects (RIBA, 1968; reported by Lawson 1997) is as follows, in short terms:

- ✓ Phase 1 assimilation (accumulation of general information)
- ✓ Phase 2 general study (investigation of the problem and possible solutions)
- ✓ Phase 3 development (refinement of one or more solutions)
- ✓ Phase 4 communication (to the design team or outside)

This model has lots of aspects in common with the UPA but is more suitable for architectural design. Lawson (1997) points out that after students collected data in phase 1 they often have problems in using the data for their design decisions. Another more refined design process described by the RIBA (1968) can be summarised as follows:

briefing (inception / feasibility) / sketch plans (outline proposals / scheme design) / working drawings (detail design / production information / bills of quantities / tender action) / site operations (project planning / operations on site / completion / feed-back)

The described process model is in fact focused on the results of the process phases. The reason is that it mainly serves as a basis for the negotiation on fees and stakes a claim for the architect as a leader of a multi-disciplinary building design team.

Another map of the design process has been produced by Markus (1969) and Maver (1970):

- ✓ Outline proposals ✓ Scheme design ✓ Detail design

Every one of the three phases has a similar „decision sequence“:

- ✓ Analysis - synthesis - appraisal (evaluation) - decision.
- ✓ Analysis (classification of objectives, ordering and structuring of the problem)
- ✓ Synthesis (generation of solutions)
- ✓ Appraisal (critical evaluation of solutions against objectives)
- ✓ Decision

To this decision sequence, return loops between appraisal and synthesis are inherent, leading to an iterative process. In industrial settings the decision formalisms are called milestones of a project.

Lawson (1997) points out that a complete iterative process would, however, require return loops between all stages.

Such a completely iterative design process today is favoured by most members of the interaction design community as well as by the different engineering design disciplines. A typical iterative design process is described by the Usability Professionals Association (UPA, 2000).

✓ analysis phase ✓ design phase ✓ implementation phase ✓ deployment phase

The detailed process is as follows.

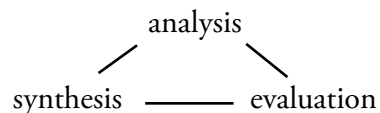
In the analysis phase visions are set in meetings with key stakeholders, a project plan that includes usability tasks is set up and a multidisciplinary team is assembled and usability goals and objectives are set. After that field studies are conducted, a competitive analysis is made. Based on this information user profiles are created, e.g. using personas that have been described earlier. A task analysis, user scenarios and finally the user requirements document will conclude the first project phase.

The design phase begins with creativity techniques like brainstorming design concepts the creation of metaphors. Every part of the design phase is iterative and concluded by an evaluation or user test. A screen flow and navigation model is created which is evaluated by walkthroughs. Only then the „real“ design with paper and pencil starts and low-fidelity prototypes are created and tested with end users. Next a high-fidelity detailed design is created and usability testing is done again. At last the standards and guidelines are documented and a design specification concludes the design phase.

In the implementation phase the designer plays a consultant-like role in the engineering team, watch over the correct interpretation of the concept and make adaptations and changes in the design. The first functional prototypes and the final product are tested with users. In the deployment phase field tests, studies and call center analyses are carried out and their results are fed back into the design of the next product generation.

While such a process description is a valuable aid for introducing user-centred aspects into design teams in industry it can be seen in practice, however, that changes in the time plan and changes in the released concepts are rather the rule than the exception. An iterative process is better than a linear one but still carries the idea of the waterfall model in it where all these models are based. More than this, different models are suitable for design than for engineering disciplines.

Actually Lawson (1994; 1997: 37) points out that not all designers do a top-down proceeding going from the general to the specific, but others (Robert Venturi, Eva Jiricna) may start with detailed design that can lead to general decisions. This leads him to a triangular representation of the three phases of the design process to which no pre-defined sequence and no hierarchy applies:



However, Lawson (1997) notes that such a rough process model does not give any specific help to a practitioner, as there is no sequence. It can even be argued that a clear separation and definition of outline and detail cannot be made, but is different for every project.

There are many more similar design process models for specific design disciplines. They all have common characteristics but a common flaw: They are made by design methodologists and not necessarily favoured or followed by good designers. This led Lawson (1997) to the conclusion that some empirical studies are necessary to bring hard evidence. He was in doubt whether asking designers could possibly reveal all details of their thoughts. Therefore he started with laboratory experiments which he hoped would contribute different aspects of the researched process. After carrying out a few laboratory experiment, however, he concluded that they did not justice to the complexity of the design process and thus switched to the method of in-depth interviews.

In the present interview-based study a few questions on the design process have been included as well.

7.100 Question 33 Do you favour a certain process model for the design process? If yes, which one?

Gründler and Zimmerman deny using a process model, while the latter definitely mentions the most important characteristics of the processes described above.

7.108 Gründler No I do not.

7.110 Zimmerman I'd love to be able to say yes to this but the answer is no. However, I have certain requirements: All design work must have fieldwork, all design work must be iterative, all design work - certainly in the interaction area, but I think in any area - needs a fairly empirical

evaluation. But other than that I don't have a specific process and I try to customise processes to the amount of time and resources given to a project, and to the specific artefact that's trying to be produced.

Also Raby mentions iteration as the most important element of a design process, while Gruber calls it nonlinear (iterative) and non-hierarchical process (as opposed to a waterfall model).

7.105 *Raby* Our process model is an iterative one.

7.101 *Gruber* We use and teach a process model derived from the findings of cybernetics and constructivism. We use nonlinear and non-hierarchical processes, some of them determined by machines or computers.

Heufler uses a model from industry very similar to the ones seen in the section before. For analysis purposes he refers to the Offenbach theory.

7.109 *Heufler* It is a process model that is based on a model of the Association of German Engineers. With this division into four: analysis, concept, design, implementation. Whereby we naturally point out that this classic linear model in reality is often a network with many feedback loops. But it is suitable to give a depiction of a model. In addition to this, for product functions we use the model "The theory of product language" from the School of Design in Offenbach, where it is about, on the one hand, categorising these product functions towards practical functions and then categorising the product language with the grammatical areas and areas regarding content, the product semantic.

The reduction of complexity is Kipcak's first requirement for a design process, while it is not enough to create an outstanding result.

7.102 *Kipcak* At the beginning of the act of designing there is always a high degree of complexity. The goal is to reduce complexity and make a simple design. Then most designers think they are finished when there is a certain degree of elegance, functionality and self-descriptiveness, but then you still need the ultimate kick to resolve things, make them relaxed and contribute the vital thing that generates design quality.

Hirschberg and Szyszkowitz both emphasises the importance of media transitions and give examples which also explain that these play an important role in their didactical concept.

7.107 *Hirschberg* I have already stated that in my courses I build things on to one another and it is naturally a strongly process-orientated teaching model. I would not call it a particular process model. I think it is always this translation, this taking over. In one course we were looking for media transitions, from physical to digital, from one programme to the next etc. To look for this transition, to make this transition repeatedly is, I think, something essential, it always leads to mental gymnastics. It is what I do, I am not sure if it is a particular process model.

7.111 *Szyszkowitz* We have made some experiment on this issue. There are two kinds of design processes, the so-called analogue one and the digital one. We had the students use both of them in parallel for the same project. Some of the students prefer the conventional analogue one: Generate a concept, build a small conventional mockup, then build a second bigger mockup, then make a first detailed drawing, capture the three-dimensionality by the mockup and add the content later, then notice that it is too small or too big - so this is the analogue way of working. - On the other hand we have the digital design process which starts with the interior spaces. The computer allows me to generate rough interior views. I have no details but I start at the opposite end, from the interior. I do not model a building surface, but I model it, I „ex-press“ the volume from inside, I press it from inside to the surface, so I generate the outside shape from inside. Then I have a look what is the outside aspect I created. - It is very interesting to compare these two methods. At the beginning the first one is far ahead, because the physical material is much easier to handle. Then suddenly the second one will catch up and go far ahead, because the computer will help to create a rendering, while the others still work on their mockup. - We do this interesting comparison regularly for five years.

Finally Domenig who during his active time at Graz Technical University has exercised an important influence on re-thinking the traditional engineering-based design processes, wants to start with a pragmatic statements but then rather highlights the importance of sketching, which is in line with the latest findings of design theory.

7.106 *Domenig* First you have to solve the organisational and functional problems. But I work in a different way. For me, architectural design is always represented in one single important drawing or sketch. For example the initial sketch for my „stone house“. I am not pre-determined to any form or any materials. When I have an idea, I express it via a sketch and then, I try to translate the sketch into reality. The selection of materials will follow out of feasibility aspects. Sketches are

very important for me. Today because of the computer many students do not know any more how to use a pencil. They all watch the computer screen and so the initial dimension is lost. I believe that it will even become worse, but maybe in five years hopefully the trend will reverse. An idea is always represented by a hand drawing. This is also confirmed by artists like Walter Pichler.

Gedenryd (1998: 3) states that design by drawing was widely considered as inadequate with the advent of computer technologies.

„(...) design-by-drawing is too simple for the growing complexity of the man-made world. This belief is widely held and may not require any further justification.“ (Jones 1970: 27)

After a period of interest in designing with computers their limitations became apparent and the revaluation of drawing and sketching has been started by Donald Schön (e.g. 1983).

While this debate among design theorists may be close to a positive conclusion, Domenig points out above that it may still take a few years before the majority of architects, educators, and students will adopt this position and do justice to the importance of hand drawing in their daily work again.

7.200 Question 34 What role does such a design process play in your lectures or seminars?

Some interviewees refer to their previous statements.

7.209 Heufler The design process plays the most important role in our lectures.

7.211 Szyszkowitz The analogue and the digital design process are compared in an experiment (see above).

While he denied using a design process in his reply to the last question, Gründler now describes the iterative principle and thereby indicates that it could be universal and independent of the discipline, be it architecture or music.

7.208 Gründler Not really. But in principle it works like this: First, make a concept or a design. Then try to implement it and then see whether it works like intended. Then I will give feedback on what went right or wrong and why, according to my opinion.

Like Domenig also Hirschberg points out the importance of sketching for the design process.

7.207 *Hirschberg* As I stated it is about design. At the moment there is a course with many students in the first semester that we are doing together with the Institute of Geometry and in the first semester they do not really design yet. This means that they solve such representative geometrical tasks. They have to construct a shadow and in the second semester design is introduced more. When these geometrical skills are present then design is increasingly introduced. I think it is indispensable, something that is fundamental from the beginning. In this sense the design is also included in geometry, but it is still relatively marginal. Here we do a hand sketch as part of every practical exercise as a warm-up. We do not show them how to sketch, they learn themselves. But through this they are introduced to the importance of the creative process.

The position that a designer has to allow failure to oneself has been illustrated by Alan Munro (2001) as follows: „Tried a hundred times, failed a hundred times. Try again, fail again, fail better!“ Raby also highlights the importance of failure in design and the implications for design education.

7.205 *Raby* Our process model is an iterative one. That is one thing that - I must admit - is very hard at the RCA. Because all the students come from some of the top universities, they have got first class degrees and they have been the stars. And they come in, and suddenly they are ordinary: They are with other first class students. And they have a difficulty, psychologically, to fail. And yet, you have to do rubbish things. That is a difficult thing we have to encourage. We have to encourage to try. I don't know how other architectural schools manage it, but in architectural schools there is a tendency to work everything out in advance and then to make a design or do something, rather than do it iteratively. So we struggle and encourage the students: „Try it, try it, do it, let's see it, come back and show me next week, then we can decide whether it's interesting or not.“ Most of the time that is quite a barrier in first year to get them to fail, to do crappy drawings and crappy ideas and be happy to do crappy stuff.

Kipcak explains that in teaching there are actually two stages of perfection: the larger group of students simply applies the rules and the smaller group is able to add real quality. From this we can conclude that in education it is necessary to have co-exist the boring iterative models from industry and the complex model of inquiry learned from experienced designers, because the majority of students themselves may not reach the skill level necessary to really appreciate the value of the latest findings of design theory.

7.202 *Kipcak* With most students we are happy to make them reduce complexity and create an average and acceptable design. But I am motivated by the best 10% of the students who can deliver real quality in design.

Gruber explains an interesting method called project handover that he uses in his seminars. Methods like this and related methods like presentation handover are also mentioned by Raby and van Kranenburg and summarised later in this text. They are certainly very valuable for design education and belong to the most interesting findings of this study.

7.300 *Gruber* A good training method for design is the circular handover of projects. An exercise is divided in e.g. eight steps, like in the following example: Creatively fold or crumple up a piece of paper; take pictures of it; make sketches of it; find spaces in it, e.g. by using a spotlight; create textures on the surfaces; write a story about it on the context of use; make a 3D simulation of it; etcetera. After every step the results are presented and every student has to choose a different piece of work to continue with. Students have to recognise first what the intention of the previous designer was.

Finally the statement by Ehn contains most of the aspects discussed above. He again comes back to the issue that simple processes like waterfall or iterative models are easy to explain and teach while the serious design model of inquiry is rather hard to learn and teach. Schön's notion of reflection on the process can help to overcome this.

7.204 *Ehn* Yes and no. I think that we are strongly focusing on a perspective that - how should I put this. We try to inform the students that in practice, things like waterfall models do not work. It is the way it could be taught, but it is not the way it works. Instead we are more focusing on different aspects or activities that go on within the design process and focusing on the cyclic nature, analysis is important but it's not something that comes before design or before construction, it's the interactive process and going back and forth. That is the model. More focus on what are the activities. On the other hand there are things like deadlines and deliverables that we still think are very important. If you are doing an exhibition on June 5th, you also have to learn how to be able to do that, to meet the deadline. You are not allowed to fail on that point. - So the group will not pass if they fail on that point. - Another thing in terms of design methodology is that we are very much in favour of making the students reflect on the process. In some projects it is even more important to reflect on the process than on the actual outcome. These are general things but it's our main attitude

to the project that you should learn to reflect on the experiences in the project that you have been doing. Look at design, analysis and construction as interwoven aspects that all are important, but not like in a phase or waterfall model. For instance you can say that a prototype is a version of the system, then you do another design cycle where you make another prototype which gets more complex and has more things in. Maybe there is also the idea that this is ongoing, and if it is a project in reality, even if there is a deadline things go on afterwards. And a final things about projects: We are very participatory design-oriented, so we use customers, clients, the different stakeholders are always to be taken into account in projects.

7.300 Question 35 Do you explicitly teach design methods? If yes, which ones?

This question is redundant to a large extent and therefore did not generate many answers. Some of them are very short indeed and repeat or refer to what has been said before.

7.308 Gründler No I do not.

7.311 Szyszkowitz Yes I do, see above.

7.309 Heufler We teach design methods. For example the one from the School of Design in Offenbach.

Kipcak emphasises the importance of the teacher's personality in design education.

7.302 Kipcak I am so arrogant to say that I represent the design method in person in my seminars.

Raby refers to her case study on design education presented in an earlier chapter.

7.305 Raby I guess there are different methods. Obviously there are certain things that they can do to learn more, it's case by case. For example the student I talked about, she was gathering all this information, and for us, until she could make a model of it, she made a hypothetical family tree. Without that diagram and without that model she had nothing. And then she had to go away and look at existing family trees, do her own family. She did a lot of research on different hypothetical marriage scenarios and that kind of thing. So it took her a long time to really make something.

Finally Hirschberg explains his didactical approach at the intersection of architecture and informatics.

7.307 *Hirschberg* As stated this process-orientation is what you could call a method, and that I always construct the course in such a way that the phases are strongly related to each other, and that I do not just talk about anything for a whole semester and expect a big final project, but I always do this in small portions and relate them strongly to each other. - *KB: The design work is then broken into phases, in which there are individual tasks?* - *Hirschberg:* Correct. It is something I do in many courses. At the moment in the basic course, in this design methods course we dealt with it very explicitly. In the advanced courses I also partly use this method. I think it is a very good way, especially in the beginning, to introduce software in a project-related way. Here one also is confronted with problems that have content, that is related to this and not just dry exercise material, but where nearer the end the project work breaks away from this structure and becomes a lot more free. - *KB: Are these project requirements available in any form?* - *Hirschberg:* They are all on the Internet.

7.400 *Question 36* Do you teach methods of how to evaluate or test designs? If yes, which ones?

While evaluations and usability tests are central in the informatics-based design discipline I expected that these methods would not have a too high importance in architectural design and other disciplines.

This is in line with Lawson (1997: 238) who points out that „all too often design students and some of their tutors (...) are content to have the ideas without testing the realisation.“

However, at the 2002 Royal College of Art (RCA) degree show I have seen a video on display showing a stuffed squirrel mounted on a remote controlled car and used in a park where other animals reacted to it or interacted with it. This could be considered as a kind of field test used by an artist in a cross-disciplinary project.

From the interviewees Kipcak and Gruber declare that they don't do any tests in their work.

7.402 *Kipcak* No.

7.401 *Gruber* Not really. Practical benefit or acceptance is not fed back into the design process. But a design competition is a kind of a test.


















<input checked="" type="checkbox"/> 	User-centred design and usability guest lectures. Very important, raise awareness for user needs.	Heu 
<input checked="" type="checkbox"/> 	Contact with potential users during field work and observation. Test economic model etc.	Raby 
<input checked="" type="checkbox"/> 	Guest lecture on usability.  But usability engineering methods are a bit of a hindrance for design.	Hir 
<input checked="" type="checkbox"/> 	Compare own work with others'. Teacher plays the users' role (cognitive walkthrough).	Szy 
<input checked="" type="checkbox"/> 	Only physical methods: Psycho-acoustic effects of data compression, the listener's reaction.	Grü 
<input checked="" type="checkbox"/> 	No feedback of practical benefit or acceptance into design process. Only competitions, articles, exhibitions give feedback.	Gru 
<input checked="" type="checkbox"/> 	Lack of user feedback in architecture. No research institution for this. But certain buildings work well in practice.	Dom 
<input checked="" type="checkbox"/> 	No. / None.	Kip 

Table 21: Teaching evaluation or test methods

Gründler reports of some test methods from the world of sound.

7.408 *Gründler* I only teach classical physical measurement methods. They can be used to measure and test psycho-acoustic effects of data compression or masking effects. We can also assess the listener's reaction on a sound installation.

Szyskowitz describes a method that in the usability discipline would be called expert evaluation.

7.411 *Szyszkowitz* An evaluation method that I have described earlier is to compare the result of one's own work with the work of others who have worked on the same task in parallel. Also the tutor will evaluate and give feedback. I also play the role of the user. For example I always check whether I would find the entrance even when I am drunk, or whether I would fall down the steps. I check whether the building will suit all ways of use, for example a party. It needs to be spacy enough, and it needs to be representative.

Heufler and Hirschberg co-operate with usability educators.

7.409 *Heufler* This is also taught here by Martina Molnar and Konrad Baumann.

7.407 *Hirschberg* We invited people from the Institute of Informatics and Computer-based new Media (IICM) to do a course on usability concerning user interfaces. For me usability seems to be a bit of a hindrance, if one makes the people too aware of it when they are designing something. I do find it important that they are confronted with it. Generally it can be said that the architects perhaps lack a feeling for the usability tests. Therefore, I find it important that they know they exist. But one cannot claim that I include a lot of these test methods in my course, or that the student-projects are tested in this way. I consciously do not do this.

Zimmerman reports of a wide variety of methods from which he uses a part.

7.410 *Zimmerman* There are other courses at Carnegie Mellon that teach the very traditional HCI methods on the usability side. So this would be like heuristic evaluation, GOMS, contextual inquiry. I don't focus on that. I try to stick with more design evaluation methods. So perceptive sorting, how people organise things that may seem to be unrelated, or comparison of design items. Very qualitative evaluations using Likert scales, focus groups and cognitive walkthrough.

Raby reports of the methods of observation and thought experiment or scenario which leads to a hypothesis.

7.405 *Raby* Yes, we always have got a site and the students always go to the site. Then they always try to find a group of people who have some kind of relevance. So we always connect them. Architects tend to work all out without ever meeting anybody. In that first term, we get them to follow people in the streets, to find people they can do projects with, for example in a market. So there is observation within the site. We always look for an economic substantiation, they will go and say „who would pay for that?“. If we have a kind of economic model then a company becomes involved, something that can be inspirational sometimes, if they have to think about an economic model. If a company becomes involved then it is a relationship within that company and that group of people. We go through a series of layers or levels, from people to companies to scientific or technical research that backs up their hypothesis. It's that what takes almost the whole term. Every time they come back there is another thing that they have to look, check and test.

A different innovative kind of field work is called cultural probes. This means to send out tools like cameras or sketchbooks to people and ask them to send back pictures, sketches, text and other input to a certain topic (compare Gaver 2001, Dunne and Raby 2003).

7.500 *Question 37* What role do test methods play in your lectures and seminars?

Like in most questions there is a range of positive and negative answers from the interviewees

7.502 *Kipcak* None.

7.501 *Gruber* We do not really do that. But we organise exhibitions and articles in newspapers in order to get feedback from the public.

7.507 *Hirschberg* These are taught. In this case it was a guest speaker. They are not so important in the course, in the sense that I would include them in exercises.

7.509 *Heufler* They impart, they have a high status in the heightening of one's awareness for the success of the design. And finally of course it is the main thing that the product is adapted to the needs of the user, and here the tests are imperative.

An interesting remark is made by Domenig who detects a lack of user feedback in architecture. This is highly understandable and may lead to some valuable future work for architectural psychology or we may call it architecture-related usability engineering.

14.306 *Domenig* I have always experienced a lack of feedback from the end users. When I do an architectural project, my only goal is to make the future users feel good. But I never experienced the users' reaction to my work. There was no institution that would have researched this user feedback. However, we can state that my Graz University building for the law, social and economy sciences (ReSoWi centre) works. I have won a nationwide competition, despite the fact that I proposed larger spaces than required, because the project included some reserve spaces and some rooms are higher than necessary for enhancing the quality of experience. Originally the project was planned for a certain number of students and employees. Because of the raising number of students, there are more than twice as many people studying and working there now. The building still works and supports this number. So maybe this answers your question.

Theoretical reflections on the design process

This chapter is concluded with another section on the latest findings of design theory that complements the findings from the interviews.

Gedenryd (1998: 69) points out that the designer must also do „problem setting“ as opposed to problem solving, a term coined by Donald Schön (1983).

In software design, a requirements document has to be written. Since users are rarely able to write such a document, software developers usually „will produce a draft document and get it reviewed and, eventually, approved by the user representatives. Determining the detailed requirements may well be the most difficult part of the software design process because there are usually no well-organised sources of information.“ (Parnas & Clements 1986: 253; Gedenryd 1998: 70)

So he comes to the conclusion that „conventional problem solving theories are flawed because they consider the problem as given at the beginning of the design process.“ (Gedenryd 1998: 70)

However, this is not the case because: „In most cases the people who commission the building of a software system do not know exactly what they want and are unable to tell us all that they know.“ And: „Many of the details only become known to us as we progress in the implementation.“ (Parnas & Clements 1986: 251; Gedenryd 1998: 71)

Gedenryd reports an example for ill-structured design problems: „By simulating a lift scenario, the designer realises that a user may press a floor button to go in one direction, but once inside the lift, may press a lift button to go in another direction. This test case was not mentioned in the problem statement, yet it is critical for the design of a good control algorithm.“ (Guindon 1990: 288)

Constraints imposed to the designer from outside may make his or her job harder. However, constraints may also be introduced by the designer and help to simplify the situation by reducing the number of options. Therefore constraints can even appear as being part of a specific way of solution. The latter kind of constraints is flexible instead of rigid. (Gedenryd 1998: 73)

source of constraints designer / client / legislator

kind of constraints rigid / inbetween / flexible

timing of constraints given before the project / added during the project

effect of constraints restriction is a hindrance / restriction is helpful

(adapted from Gedenryd 1998)

The less a source of control over a constraint is involved in the design process, the more rigid is the constraint. If the source of control is more involved in the design process, a constraint becomes (re-)negotiable „if complying with it does not lead to a good result.“ (Gedenryd 1998: 76)

The standard view of constraints out of a ‚realist‘ philosophical position is to view them as ‚real‘, „i.e. existing independently of someone having to ‚create‘ them.“ (Gedenryd 1988: 77) However, ‚pragmatism‘ sees constraints as an instrument actively formed by a person applying it to serve a purpose. The source of control principle embodies the pragmatic position.

Gedenryd (1998: 78) states that pragmatism prefers the term ‚knowing‘ (being a verb) to the term ‚knowledge‘ (being a noun). Knowing is a capacity rather than - like knowledge - a thing stored in mind. Knowing is grounded in use.

The prototypical kind of knowledge was mathematical and used in deduction, proofs and formal logic. It became the paradigm for reasoning and even the fundamental model of cognition in general. As opposed to that, Dewey (1938) created the theory of inquiry as „the pragmatist theory of cognition. The notion of ‚inquiry‘ itself refers to those adaptive and practical, concrete activities where knowing is put to use. Cognition is held to consist in the entire activity of inquiry, not merely in a process of pure, abstract thinking. Also, all cognition consists in inquiry; it is the basic structure of cognition.“ (Gedenryd 1998: 79)

Rittel (1972) states that a sequential design process cannot work because „you cannot understand the problem without having a concept of the solution in mind; and that you cannot gather information meaningfully unless you have understood the problem but that you cannot understand the problem without information about it.“

Gedenryd (1998: 95) adds that not only the sequential nature of design processes is the basic failure, but rather the separation between them inherent to all process models. Also the following statement implies that there can be no separation of design process phases:

„Only if a similar system has already been built can a further system be consistently specified in advance with any amount of certainty.“ (Parnas 1985)

Gedenryd (1998: 98) states that iteration of phases within a process model does not improve the model but results in the same position he advocates. „By allowing for iteration, a stage model comes to saying that you can do anything, in any order, as many or as few times as you like.“ A phase

model thus is reduced to a list of possible activities that cannot be held apart. He concludes that in phase models, the phases of „understanding the problem“, „action/synthesis“ and „evaluation“ are trivialised if they are taken seriously, i.e. strictly separated from each other and before all separated from the „analysis“ phase. „Having trivialised these three other functions, the separated models push back all the important work into the analysis part; the intramental ‚black box‘ thereby seems to require magical powers when the whole task of design is assigned to it alone; hence, the air of mystery surrounding the concept of ‚creativity‘. In the inquiry model, the other three functions can make important contributions, and the burden on the mental part, and the need for magic, diminish accordingly.“ (Gedenryd 1998: 99)

My practical experience from industry shows that phases and milestones in a semi-iterative model are usually transcended by later ‚change requests‘. However, milestones have a certain positive effect of structuring the available time, e.g. speeding up people in a team. It is unclear whether this can be fully applied to design projects, while in his earlier statement Ehn declared to combine the inquiry-based design process with the pragmatic focus on deadlines etc.

7.204 *Ehn* We are strongly focusing on a perspective that (...) things like waterfall models do not work. It is the way it could be thought, but it is not the way it works. Instead we are more focusing (...) on the cyclic nature, (...) the interactive process and going back and forth. That is the model. (...) On the other hand there are things like deadlines and deliverables that we still think are very important. (...) meet the deadline. You are not allowed to fail on that point.

Gedenryd (1998: 115) presents a theory concerning the advantages of interactive cognition over intramental cognition: „The programmatic way in which traditional theory has not ‚forgotten‘ or ‚neglected‘, but explicitly kept the world out of cognitive theories, is reflected in the quotation (...) about the need to place a buffer around cognition to protect it from the ‚unpredictable environment‘.“

This argument can be well compared to the user-centred design guideline that aims at a reduction of memory load by placing knowledge in the user interface (or in the environment). Thereby the error rate will be reduced which means an improvement in usability. There is a parallel between a usable interface and a design process well-adapted to the cognitive abilities of the designer, which reduces memory load by placing knowledge onto the drawing paper instead of imagining it. Furthermore the interaction between the designer and the drawing which implicitly gives him or her feedback

on the idea is an essential benefit of thinking by drawing over pure reflection.

„The pragmatic manner is a very simple way to find out. Logical deduction, dead reckoning, and so on are techniques that enable you to figure things out when the basic, simple way of finding out by checking is not available, as in metaphysics and so on, just as a writer has to compensate for not having her addressee in front of her. The rational ideal has made the mistake of regarding deduction from premises as the fundamental procedure for finding things out, not a compensatory technique for circumstances beyond the ordinary. It is thus like a literary model, in having been applied also to situations where the special, limiting conditions that motivate it do not apply.“ (Gedenryd 1998: 120)

In search of a model of design problems Lawson (1997: 83) starts with a description of the involved parties, the generators of design problems: clients, users, designers and legislators.

Clients: At first sight the generator of a design problem is the client. However, designers can discover problems on their own, or legislation can impose them. The client plays an important role in the design process. He or she needs to clearly communicate the design brief. Often clients are not used to their role, others do this as a job. Lawson (1997) states that often clients do not fully understand the problems related to the design task.

Users: Often the clients will not use the design product (e.g. a building) themselves. „Frequently communication between designers and their users is both indirect and (...) filtered by organisational politics.“ (Lawson 1997: 85) There are communication gaps between designers and users as well as between clients and users. (Zeisel 1984) It has not been of great help to establish a collaboration between designers and ergonomists, psychologists and sociologists, because science is descriptive while design is prescriptive.

Designers: „It is sometimes difficult to separate design from art.“ The creative process in art shares a lot with the design process. „A designer is usually more constrained than an artist.“ (Lawson 1997: 88) The work of both designers and artists is determined also by their own personal interests, but designers clearly are less introspective and more influenced by real-world issues.

Legislators: Legislators generate rules and different kinds of authorities supervise the compliance of every design instance to these rules. Clearly legislators are the least flexible party in the process. (Lawson 1997: 89)

flexibility \longleftrightarrow rigidity
designer / client / user / legislator

Every one of the four groups of generators shown in the figure imposes design constraints, but with different degrees of rigidity. A balanced design solution may only be found after some design possibilities have been explored. (Lawson 1997: 90)

Designer-generated constraints are comparatively flexible. If they cause too many difficulties or just simply do not work out the designer is free to modify or scrap them altogether. Design students often fail to recognise this simple fact but instead continue to „work endlessly and fruitlessly against insuperable problems which are largely of their own making.“ (Lawson 1997: 91)

This challenge makes it necessary that students are coached by their tutor during a design project. Like in the example by Schön (1983) the tutor can help the student to overcome these problems by reframing the problem, i.e. change the problem setting.

Lawson (1997) distinguishes between internal constraints that refer to issues within the design object and external constraints that come from issues outside the design object. Internal constraints allow a greater degree of freedom since they govern factors which are under the designer's control. The purpose of design constraints is obviously to ensure that the designed system or object performs the functions demanded of it as adequately as possible.

Examples of internal constraints are the requirement by the legislator that there is a worktop on either side of the cooker, or the wish of the client that the dining-room opens directly on to the kitchen, or the architect's idea to organise all spaces around a central service core. Examples of external constraints are regulations for fire prevention defining the distance of windows from boundaries, the preference of the client for a garden view from the living-room, or the architect's wish to continue the existing street facade. (Lawson 1997: 93)

For a product designer, internal constraints include the problems of fitting an object together. For an architect, the concern of protecting the Cologne skyline as an external constraint led to the solution of the new Rhine bridge, like Lawson (1997: 95) explains in his book by this case study.

External constraints can make a project specific. In the 20th century there was a debate between architects favouring either a site-specific or a universal, international approach. The international style became central for the modern movement. (Lawson 1997: 97)

In our interview study one of the final sections is dedicated to the question whether local or international aspects are preferred. There are statements in both directions from the interviewees.

Lawson (1997: 99) believes that perhaps one of the reasons why students of architecture find housing design so difficult is because the balance of external and internal constraints is very even.

Hillier and Leaman (1972) organised design constraints for buildings in the functions of modifying climate, behaviour, resources and culture.

Lawson (1997: 103) organises design constraints in the categories of radical, practical, formal, and symbolic constraints. A similar classification is also used by Heufler and mentioned in his statement on evaluation and grading of design skills.

The radical constraints are those which deal with the primary purpose of the object or system being designed, meaning that these constraints are 'at the root of' or fundamental to this purpose. E.g. when designing a school the radical constraints come from the educational system the school is there to implement. (Lawson 1997)

The practical constraints are those aspects of the total design problem which deal with the reality of producing, making or building the design; the technological problem. The formal constraints are those to do with the visual organisation of the object. They may include rules about proportion, form, colour and texture. (Lawson 1997)

The symbolic constraints deal with the expressive qualities of design aimed at achieving specific effects at the side of the users, providing a symbolic meaning. Symbolic content of design is often seen critical by architects. (Lawson 1997)

Lawson concludes that it is the designer's task to integrate and co-ordinate all these constraints by whatever device. So the complete model of design problems by Lawson (1997: 107) is three-dimensional as figure 24 shows.

Of course there is overlap between the functions of constraints. Therefore the model is not intended to form part of a design method but rather as an aid to the understanding of the nature of design problems, and thus only indirectly to assist in establishing a design process. Lawson (1997: 109) points out that different situations like designing motor cars, architecture or advertisements differ only in the degree of importance attached to various aspects of the problem.

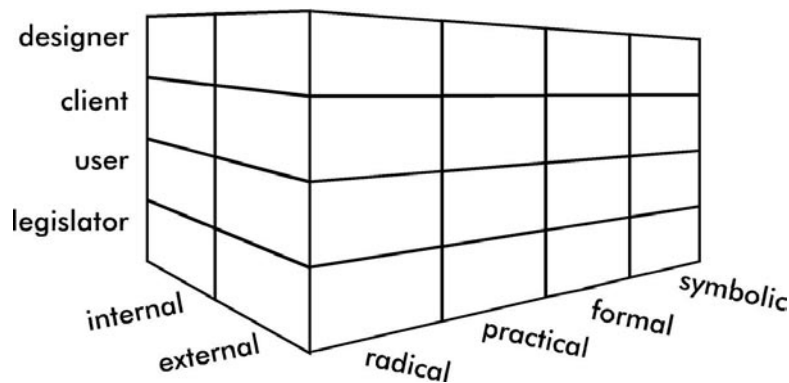


Figure 24: Three-dimensional model of design problems adapted from Lawson (1997: 107)

„Students of design often devote too much of their time to unimportant parts of the problem. It is easy for the inexperienced to generate almost impossible practical problems by slavishly following ill-conceived formal ideas which remain unquestioned but could quite easily be modified. One of the major roles of design tutors is to move their students around from one part of the problem to another and the job of the students is to learn to do it for themselves. Here again the model of design problems may be useful acting as a sort of checklist of factors to consider. Almost certainly, the skilled and experienced designer is unlikely to behave so self-consciously, but the novice student needs to learn to develop a balanced design process exploring all the important constraints, whoever generated them, whether they may be internal or external and whatever their function.“ (Lawson 1997: 110)

Ethical aspects have not been emphasised a lot in our study, while they have been mentioned e.g. by van Kranenburg. However, „it has been tried several times in history to base architecture on ethical or moral ‚rightness‘.“ (Lawson 1997: 163)

Also the user was not always in the centre of design thinking, while repeatedly in the history of architecture the user was re-introduced as a constraint. Le Corbusier proposed the „Modulor“, a proportional system based on numbers derived from the ratios of parts of the human body.

„The attitude towards client-generated constraints varies from designer to designer. (...) I have found that one of the characteristics which many very good designers share in common is the extent to which they focus on the client and see the client playing a role in the very design process itself. Certainly a supportive and understanding client can make an enormous difference to the success of a project.“ (Lawson 1997: 171)

„Users are all different and likely to make differing demands on the final design. The different kinds of users involved in buildings often make this extremely complex. (...) What students think makes a good lecture theatre can be almost diametrically opposed to the views of their lecturers.“ (Lawson and Spencer 1978; Lawson 1997: 172)

The Dutch architect Habraken (1972) believes that ,the process simply does not work if the occupants are not involved.‘ (...) „This leads to a design process which consciously allocates responsibilities between designer and user.“ (Lawson 1997: 173)

Also Christopher Alexander has included participative design into his work.

More than this, guiding principles can obviously be derived from practical constraints, radical constraints, as well as formal and symbolic constraints. (Lawson 1997: 177)

„In the 1960s and 1970s the idea was that if you got the ergonomics right, the moulding right, the material right and usability and function correct, then in a mysterious way it would make itself into a good design.“ (Gardner 1989)

Concerned to develop a sense of regional identity in the face of unthinkingly imported western architecture, the Malaysian architect Ken Yeang began to study locally traditional forms and construction of buildings, which led him to focussing on a response to the local climate. (compare Lawson 1997: 181)

A designer's guiding principles and concrete design problems he or she works on influence each other. „In this sense, design is also a form of research (...).“ (Lawson 1997: 183)

The generation of design alternatives can be considered as a sign of doubt. Since the designer must develop only one solution - like the architect Santiago Calatrava points out - „it is not a question of options, it is always a linear process.“ (Lawson 1997: 214)

In a design process using alternatives, „the designer generates many ideas each of which have at least some possible advantages, rather than focusing on one idea too soon. The process then becomes a matter of eliminating unworkable or unsatisfactory ideas and choosing between the remainder, possibly combining some features or several.“ (Lawson 1997: 215)

The architect Michael Wilford has taught in schools of architecture and finds that „students often have difficulty producing a range of ideas. (...) They are locked into a solution without having a full

spectrum available to judge whether that is an appropriate solution.“ (Lawson 1997: 217)

„Identifying all major alternatives may be extremely valuable both for discussions with the client and for establishing some firm foundations for the rest of the design process. The tutor in a design school is usually only too well aware of this. When setting a class of students the same problem, it often seems that there are only half a dozen or so valid and sensible basic solutions with many variants and combinations.“ (Lawson 1997: 218)

„When we examine the drawings done during the design process it is often possible to detect what we might call ,parallel lines of thought‘.“ (Lawson 1993; 1997: 218)

„Good designers are able to sustain several ,conversations‘ with their drawings, each with slightly different terms of reference, without worrying that the whole does not yet make sense. This important ability shows a willingness to live with uncertainty, consider alternative and perhaps even conflicting notions, defer judgement, and yet eventually almost ruthlessly resolve and hang on to the central idea. This suggests that perhaps a particular personality is helpful here and that design education needs to inculcate these vital skills.“ (Lawson 1997: 226)

Design schools or movements

„Design education has recently emerged from a period of treating history as deserving academic study but making little connection with the present. Modernism tended to be interpreted by some as the end of history. Thankfully those notions have been largely rejected and the design student of today is expected not only to appreciate historical work in its own right but to use it to inform contemporary design.“ (Lawson 1997: 5)

„Design education, like design itself, will perhaps always be controversial. Traditions have grown up which show structural variations not only between countries, but also between the various design fields. The extent to which the various design fields share a common process is a matter for considerable debate. That designers educated in each of these fields tend to take a different view of problems is less contentious. Furniture designers will tell you that they can spot furniture designed by an architect as opposed to someone trained in furniture design.“ (Lawson 1997: 5)

This question has already been posed at the beginning of the interview in a modified form. Here it has been repeated, and by the fact that there are several consecutive and overlapping questions we can see that repeating a question or insisting on a question often produces good results. New information has been gathered even by the last one of several similar consecutive questions. The same phenomenon could be seen in the chapter on creativity.

8.100 *Question 38* *Are there works of design that have influenced you and your work?*
If yes, which ones?

Here, Gruber referred to his answer to the question in the first part of the interview guideline. Some of the interviewees repeated their earlier statement. However, some interviewees mentioned additional names to those they originally stated.

8.102 *Kipcak* Scandinavian modernism that started in the 1920ies. Alvar Aalto, Kai Frank, Ralph Erskine. Also the usual canon of literature and film.

8.103 *Kranenburg* Bauhaus was one of the most important design schools. The most interesting thing about Bauhaus is that according to Gropius the most successful Bauhaus unit was the pottery

Works of design that influenced you:		● individual ● group
The architects I worked with.	Gru	●
Scandinavian modernism. Alvar Aalto, Kai Frank, Ralph Erskine. Literature, film.	Kip	● ● ● ●
Bauhaus. Gropius.	Kra	● ●
Donald Schön, Chris Agers. Jewish philosophy. Ludwig Wittgenstein, Gene Laving, Akgin Wenger. Collaborative design. Socially engaged projects.	Ehn	● ● ● ● ● ●
Fischli and Weiss video. MIT Media Lab. John Maeda. Ben Shneiderman. Tufte.	Hir	● ● ● ● ● ●
Peter Hoffmann, Richard Kriesche. Frank Zappa.	Grü	● ● ●
Offenbach Design School. Richard Sapper.	Heu	● ●
The up-and-down of trends and movements in the history of architecture or fashion.	Szy	●

Table 22: Design schools or movements and their influence on design education.

workshop which was 25 miles outside of Weimar. You will not change people, places or organisations - they can only do that themselves. You need a vision, that's all, and from this vision everything else follows.

8.109 *Heufler* Here I must refer to Offenbach and Sapper. There is also this quotation from Sapper: "We should not invent new products that already exist and nobody needs, but products that do not exist and that we do need." A classic quotation from him.

An important contribution again comes from Pelle Ehn who probably has dedicated already a large amount of research and thinking to these questions.

8.104 *Ehn* Yes, there are design philosophies that have influenced me. As I said, the way of thinking about the reflective practitioner that Donald Schön, Chris Agers and others developed is quite fundamental. So in general, the Jewish philosophy of learning by doing is quite important. I wrote my thesis about trying to develop a design understanding based on the notion of intertwined language games in the late Wittgenstein work. That basis of trying to understand language games, of intertwined communities of practice is quite fundamental. So you could also say that work by Gene

Laving and Akgin Wenger on communities of practice would be important, too. Some of my work influences quite a lot, I think. It is quite fundamental to look at descriptions not as descriptions but as design artefacts, so the interplay between actors and design artefacts, trying to understand what is the role of a text, of a programme, of a mock-up, of a game, to see how they are intertwined in the design process. A fundamental idea in our design philosophy is the idea that it is very important to communicate. We will never understand each other, but the best we can do is to set up joined design activities where users, customers and professional designers can learn from each other and create a shared practice that everyone can take home afterwards. And finally there is an ethical component and an aesthetic component in our way of thinking in design. Not aesthetics as beauty but thinking of the importance of a "Gestaltung" (design) that fits in its context. It is very broad. It is always so culturally embedded. And also there is a very strong philosophy of trying to engage in projects that socially make a difference.

8.107 *Hirschberg* Yes, I am just thinking if there is anything from the new media that has strongly influenced my work. There are several artistic works. I often base a course specially on a work of design. For example „Der Lauf der Dinge“, this video by Fischli and Weiss. The course „Advanced 3D Modelling and Animation“ was orientated on this video; that one tries to design in virtual space a similar fascination of things, and then from this example that should in no case be reproduced in any way, but it should be seen as a stimulus; that one tries to translate it into a language of new media and begins to analyse the perception phenomena. Apart from this, I have already mentioned the work on Media Lab; John Maeda and such people have opened the eyes of many people. I often use „Design by Numbers“; especially in the area of information visualisation I use the books by Shneiderman or Tufte.

Some totally different names in this context are mentioned by Gründler.

8.108 *Gründler* Well, I have a totally different education in medicine. So most of what I do now I have learned it by myself. There are two artists who reflected on the media, Peter Hoffmann and Richard Kriesche, who had a strong influence on my work. In music my background is in rock music, Frank Zappa. Now I am doing electro-acoustic improvisation music.

Zimmerman states that the question is not really appropriate for him.

8.110 *Zimmerman* That's a very hard question. This is hard to apply to me.

**Are you an exponent of a design movement?
Is this reflected in your teaching?
Do you highlight design movements in your seminars?**

<input checked="" type="checkbox"/>	There is a strong influence. Current trends are important. Everyone wants to be a trend setter. / Students want to see what their teachers do in design. / Compare history and present. What is timeless and of universal value? Ergonomics is not subject to fashion.	Szy
<input checked="" type="checkbox"/>	Fashion and trends are hugely important and relevant to design. Students need to master both long-lasting and short-lived design.	Zim
<input checked="" type="checkbox"/>	In my lectures I provide an overview on styles and movements worldwide in architecture, intellectually, and zeitgeist. Today there is a variety of ways.	Dom
<input checked="" type="checkbox"/>	No, but influence of Scandinavian tradition of modernism. / No influence on teaching. I try to avoid fashion trends in seminars. It is hard because we live within our time. Trends are very strong in general. Opportunistic design is not good design. / I discuss this with the students in a critical way.	Kip
<input checked="" type="checkbox"/>	No, but I am influenced by what I see somewhere. I would prefer to set the trends.	Hir
<input checked="" type="checkbox"/>	No, there is a variety. Every designer has influences. Functional design. Team work. Adaptation to serial production. / Every school is influenced in a different direction. / We analyse trends and promote discussion. We do not discriminate them, but try to keep them out.	Heu
<input checked="" type="checkbox"/>	No, I do not think so. / Only a kind of minimalism: "Can I reduce further?"	Grü
<input checked="" type="checkbox"/>	No. We limit this. Teaching is long-term oriented. / Constructivism, surrealism, pop art.	Gru

Table 23: Design schools or movements and their influence on design education.

8.200 *Question 39* Do you consider yourself as an exponent of a design school or movement (e.g. deconstructivism) or do you feel being close to one or more of them? If yes, to which ones?

A wholehearted agreement to this question only comes from Szyszkowitz. He describes the cyclic nature of styles in design and architecture.

8.111 *Szyszkowitz* Historic development of architectural design and styles is an important issue for me, as well as the up-and-down of priorities. What seems interesting in one moment to us will become unimportant and be neglected by the next generation or even a few years from now. This phenomenon can always be seen. We change priorities and this up-and-down repeats always. There is a phase of constructivism which will be dissolved sooner or later. Then a deconstructive phase follows because we have enough of the previous one. We play with this. Every extreme position will become boring or unacceptable sooner or later. And when we have reached the other extreme we turn and come back to constructivism, because we will be happy to recognise principles of order again, so we will want to construct, to order and to put the bricks on top of each other again. The same can be seen in fashion design and the use of colours. As soon as we all wear pink clothes, fashion will certainly change the colour and we will be bored of it. These cycles are natural. It is like eating pork every day will become boring, so we will be happy to have a dry tomato. - This also applies to history of course. We can see in history that every revolution has been followed by a counter-revolution, or counter-reformation.

The five remaining interviewees who answered this question did not agree with belonging to a style or school or being influenced by these. Only Kipcak to a certain extent agrees with an influence by Scandinavian modernism, while Heufler names functional design as his basic direction.

8.208 *Gründler* No I do not.

8.201 *Gruber* I had the chance to work with important architects who influenced me, but I do not consider myself as part of a movement.

8.202 *Kipcak* I do not consider it as a movement and myself as an exponent, but I have adopted a way of life which influences my work. It is the Scandinavian tradition of modernism which proposes an utopian vision of normality.

Hirschberg mentions an interesting phenomenon, namely that innovations or new design ideas often happen simultaneously but independent from each other by different people. On the other hand of course there are direct influences and mutual inspiration.

8.207 *Hirschberg* I do not see myself as belonging to one school. And the people that I mentioned were not directly my teachers; but these are things that I come across and find interesting and then I try to implement them in the course. In this course we analysed and discussed fruit. I do not know of any course where work is done like this. Interestingly enough colleagues from the institute pointed out artists who have done similar things with, in this case, plastic fruit. I see the course as a type of project work, where we always develop new projects, where we also always newly orientate ourself. In the team or individually we find new things that we would like to try. We see something somewhere and it is a stimulus, at congresses, museums, books, etc.

Heufler considers this issue from the pragmatic and industry-focused point of view that is reflected by his institute.

8.209 *Heufler* Actually no, out of the simple reason that we live in a pluralistic society, where there have to be a variety of creative directions. Naturally every designer is influenced during the course of his career by certain philosophies. It is important for us – especially in the education stage – to be open and to point out a variety of possibilities. - One could name a fundamental direction – the direction of technical-functional design as opposed to artistically orientated object design. Also the question of the ability to work as a team as opposed to the artistic individual competitor, these are definitely movements that we follow.

8.300 *Question 40* *If yes, is this reflected in your teaching?*

8.301 *Gruber* No.

Similar to Heufler's statement above also Kipcak makes a point for respecting the individual way of working of the students.

8.302 *Kipcak* This is my way that does not have to be adopted by my students. I have students who are excellent in different ways and I respect that as far as the level is ok.

Heufler explains the need for educational institutions to create their profile and to improve their unique strengths. This profile also has to be promoted, a notion which is certainly well-known in the USA but due to the public status in the history of university education in most European countries it is a new challenge for their schools to position, advertise, market and promote their services as products.

8.309 Heufler In a certain sense it definitely dominates our lectures, also due to the fact that the Austrian design institutions are influenced in different directions; a classic example of this is the University of Applied Arts in Vienna. The variety in the education and the differing possibilities for the students is seen by us as enrichment and not as competition. For this reason, that is, not to do something similar, we must go in a different direction.

Domenig has mentioned styles and movements two times in his interview; therefore his statements carry two different numeric values. He states that today there are no styles in architecture any more. Also he mentions that students sometimes copy work from the Internet which is an important issue for design educators today.

3.106 Domenig I provide an overview on the styles and movements that exist worldwide, not only historic movements but also intellectual movements, zeitgeist movements.

8.306 Domenig I always try to provide access to the different styles and schools of architecture that exist worldwide, but I try not to show any preferences. For example I do not like to emphasise Deconstructivism, because this movement has already been there for hundreds of years. I prefer to show the whole range of styles and movements and I do not evaluate them or express a personal preference for any of them. These are the different languages of architecture. As opposed to earlier, historic times, there are many architectural languages worldwide today. In earlier times there have been styles, they do not exist any more. Today there are many different methods and ways of how architects are working. Something which is really difficult is to prove to a student that he has copied an idea from somewhere else. Today there is the Internet which allows the students to search for a specific topic like school buildings or museum buildings. So the student can copy projects or ideas worldwide via the Internet. Maybe the teacher does not know the original, but it is still possible to check this. At the end of the day every student is self-responsible for the quality of the education and whether he or she does some work.

8.400 *Question 41* *Are there other design movements that are highlighted in your lectures or seminars?*

The answers to this question have been already mentioned above to a large extent, e.g. Domenig and Szyszkowitz gave a positive answer.

8.401 *Gruber* This is hard to say, but the classic movements like constructivism, surrealism or pop art have an influence on everybody in our discipline.

8.409 *Heufler* The combination of design with engineering is of high importance. This means that we emphasise the implementation of designs in view of serial production.

8.500 *Question 42* *Do you feel your work is influenced by current trends or fashion?*

On one hand Gruber, Kipcak, Gründler, and Heufler rather try to avoid the influence of short-term trends in the education they offer.

8.501 *Gruber* The influence of fashion and trends is small. We try to limit this, because our teaching needs to be long-term oriented. Fashion can lead in a way with dead end.

8.502 *Kipcak* I try to avoid trends and fashion in my seminars. I am happy when I see that my old work is timeless. But it is hard to avoid fashion trends completely because we live within our time and with our technical possibilities.

8.508 *Gründler* I do not think so. There is only a kind of minimalism. I ask myself: Can I reduce further, would an important aspect be missing if I reduce further? - But this is not really a design movement.

8.509 *Heufler* We analyse such trends and fashions, but due to experiences we try to keep the perspective and to point out short-lived and probably disappearing fashion trends, whereby students naturally due to their youthful potentials analyse these very intensively and we promote the discussion in this direction. One definitely cannot cut it out. This theme is analysed and discussed, but it should not turn into a permanent change of fashions.

On the other hand Hirschberg and Szyszkowitz see a strong influence of trends and fashion and are not against it.

8.507 *Hirschberg* Fashion trends are definitely part of this. Whereby sometimes one would like to come away from the fashionable trends and not limp behind them. I prefer the feeling that we set the trends. This is the way I see it - I am not sure it is correct.

8.511 *Szyszkowitz* There is a strong influence. A current trend is of generally high importance. There is a wish to be a part of it, of being a trend setter, of being part of the avant-garde, because we need to push things further. „Avanti, avanti!“

We can conclude that like in most questions addressed in this study there is the full range of different opinions available within the eleven interviewees.

8.600 *Question 43/44* *How strong is the influence of fashion and trends to your discipline in general? If you feel there is a strong influence, how do you react on it?*

The influence of fashion and trends is generally estimated as high. However, only a few interviewees answered this question.

8.602 *Kipcak* It is very strong. There we see the difference between opportunistic design and good design.

8.609 *Heufler* In design one must look permanently left and right, forwards and behind. Cultural influences or influences from art, from architecture, also technical innovations influence us. Also fashion in clothing plays a part. We try and observe this as a whole and under no circumstances reject or hold onto it. I think that the discussion about and analysis of fashion is crucial - and not the rejection or discrimination of fashion.

A similar statement from Gründler applies to the area of music.

8.608 *Gründler* There are trends like for example digital audio technology. I teach the communication chain from sender to recipient, from a musician to the perception phenomena. You need to know all related aspects if you like to build a system.

8.800 *Question 45* *Does your attitude towards trends and fashion influence your lectures or seminars?*

A few interviewees unanimously answered this question in a positive sense. Kipcak and Heufler use the method of critical discussion of student work, which is in line with their restrictive attitude towards trends stated earlier.

8.802 *Kipcak* Yes I discuss this in a critical way. When I see a certain attitude in a student's work which is currently en vogue, in the mainstream or even in the underground mainstream, I will point it out and discuss it.

8.809 *Heufler* As I already stated it mainly happens in the form of discussions with the students and related to the question of target group orientation.

Zimmerman and Szyszkowitz on the other hand seem to more actively face the students with latest trends, which again is in line with their more open attitude towards fashion and trends.

8.810 *Zimmerman* Oh yes, I think fashion and trends are hugely important and hugely relevant to design in ways that they are not at all relevant to social science or computer technology. One of it is making your students aware of what work might be more long-lasting and of what work might be more flash-in-the-pan. They need to master both to be successful.

8.811 *Szyszkowitz* Yes this is reflected in my teaching. First of all, the students want to see what the latest trends are. What is our latest building? What has been presented in a magazine? What do we (the teachers) read or watch? I believe we can explain historic architecture much better if we compare it to recent one. I will recognise what is en vogue, and what are the fragments that remained from the outdated. So what has been of timeless, universal value in a design? For example the haptic and ergonomic properties of furniture have a high importance, because they are based on the users' properties. People will always sit best on a 42 to 45 cm chair, and they will always sleep best in a horizontal position. It is hard to change this and do it vertically.

According to what we found out in the analysis of the interviews, Lawson reports of similar findings in this issue from his series of interviews.

„I have been privileged to study the work and process of a considerable number of leading architects and find none of them think of themselves as working within a ‚style‘, and yet all have strong intellectual programmes behind their work. Many architects today regard the styles of architecture more as inventions of the critics than as sets of rules which they themselves follow.“ (Lawson 1997: 165)

The ideal form of design education

Design and architecture are taught at different types of educational institutions: universities, academies, polytechnics and post-graduate schools.

Universities are the classical institutions for higher education. Several study programmes for architecture and other design disciplines are offered at universities.

Academies in Austria have filled the need to offer higher education in the graphical arts, architecture, design, music, and theatre. In contrast to universities they always had a limited number of students and therefore applicants had to pass an entrance examination. The way of teaching is more centred around seminars and master classes. In Austria academies always had a rather high reputation.

Polytechnic schools or colleges are not standardised internationally. In the 1990s the Austrian government created a new type of educational institutions called „Fachhochschule“ (FH). By this step Austria followed Germany's example where a similar type of school was established in the 1970s. An FH is comparable to the UK's polytechnic. According to the current inflation of wording most academies and polytechnics call themselves universities respectively universities of applied science. The first disciplines offered at Austrian „FH“ were technical and economical ones in order to meet the industry's demand for young, professionally trained practitioners specialised in a well-defined

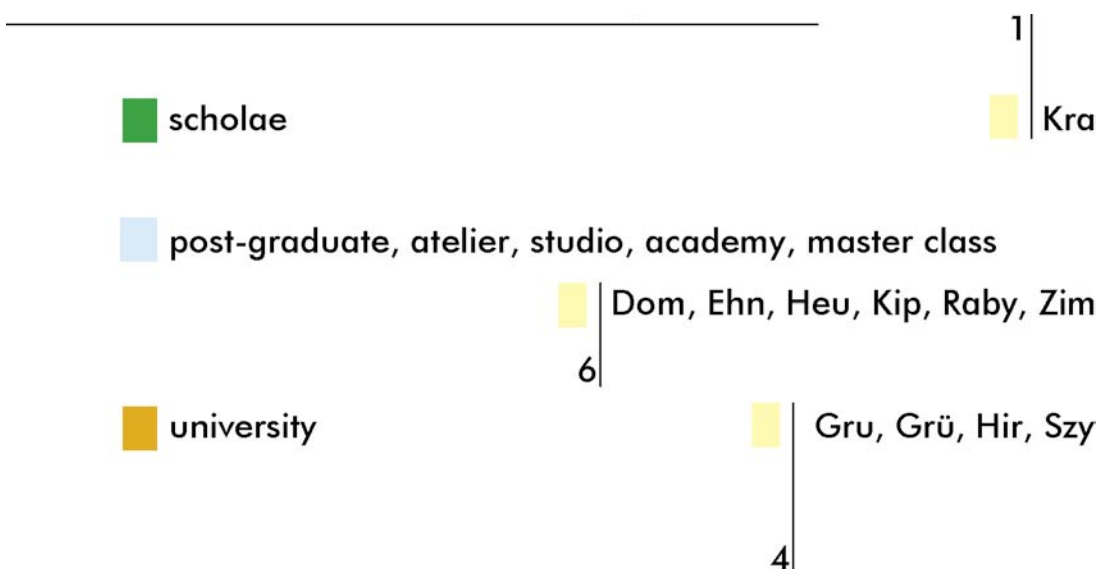


Figure 25: Ideal kind of design education

area. The education takes four years, three of which are spent in the classroom. In the remaining year, students have to do a four months internship and write a diploma thesis. Depending on the curriculum the mandatory internship can also take place in the third year. This type of education is aimed at serving the industry's need for people having a practical-oriented training in technical or economical disciplines.

There are several differences between an Austrian FH and a university: Attending lectures and seminars at an FH is mandatory, the number of students is limited, and applicants have to pass an entrance exam consisting of written and oral part, and show previous work in the case of certain disciplines. FH programmes are more narrow than university programmes, and have to differ in title and content from existing programmes. From a legal standpoint FHs are private companies. There is only one type of full-time teacher and no lecturer/professor hierarchy. Usually the percentage of external part-time teachers is high.

Post-graduate schools and private universities are the fourth type of institution in higher education. In Austria their history is even younger than the one of polytechnics. They have been founded during the last few years only. I am not aware of any design study programmes offered so far. Most programmes offered are technical or economic ones. In the UK, however, there are post-graduate design schools like the Royal College of Art.

9.100 Question 46 What is for you the ideal kind of education or training in your discipline? Is it represented by universities, polytechnics, colleges, academies or other schools? Is there a difference depending on whether a student likes to become a practitioner or a researcher?

As the ideal way of design education van Kranenburg makes a point for one-to-one education. His ideal is the ancient greek education type called „scholae“ which is at the root of our word schools.

9.103 Kranenburg As I said, the ideal type of teaching/learning situation is the one of two people going out for a walk and talk. The thing is at the moment, when you go to schools, and you go into Philosophy departments, it's all about Platon and Aristoteles. They all talk about philosophers who are already dead for around three thousand years. But Platon and Aristoteles did not talk about philosophers who were already dead for three thousand years, but they took you out for a walk and talked about (reality). And so some are saying that at some point along the line, things were going

Ideal kind of design school / concrete examples:























	Scholae (ancient Greek type): one teacher and one student at a time; walk and talk, one hour per week. One mentoring day per week. Group discussion. Carsten Komp. / Antwerpen. / Drawback: very time-consuming.	Kra 
	Academy, master classes. Vienna Academy of Applied Arts. / Problem: everything depends on one person, the master class leader.	Kip 
	Atelier or design studio: Bauhaus in 1920s / Malmö school / RCA-ID London / IDII Ivrea / ITP School of Art, NY / Queensland Univ. of Techn. / Constant re-creation and change.	Ehn 
	Max. 20 students per full-time teacher. Good schools are never oversized. Time limit for students to pass exams.	Dom 
	Post graduate, studio-based, two years. / Royal College of Art / Architectural Association / Bartlett (all: London) / Unit system - like master classes. / Foundation year at beginning, learn several skills, then decide. / Students interdisciplinary backgrounds. / First and second year together.	Raby 
	Training from and by practitioners. Specialists in design with the ability to include other skills. / Offenbach school. Royal College of Art. College of Art and Design in Pasadena, CA.	Heu 
	Interaction design as masters and PhD programme accessible with a variety of backgrounds: graphic design, writing, film, architecture, engineering, psychology etc. / No bachelor, interdisciplinary.	Zim 
	University: independent from economic pressure. / Cooper Union, NY. / Both, small and big schools have advantages (individual tutoring / pluralism). / Possibility for experimental work, not too job-oriented. Broad, unspecific, long-lasting knowledge.	Gru 
	University: Freedom, no economic pressure. New media. Research. / Learn from others. Final crits. Prizes for best theses. / MIT Media Lab / ETH Zurich. / Close link to practice. / Seminars max. 30 students. / Exhibitions.	Hir 
	University didactics by K. Horn. Anglo-American academic culture and literature.	Grü 
	University; max. 30 students per year.	Szy 

Table 24: Ideal kind of design education

wrong, things mugged up. The ideal form of teaching is „scholae“. There was the old greek word „scholae“, that means leisure. And we turn this into schools, which is completely crazy of course.

At a different point during his interview van Kranenburg criticises the industry-focused concept of polytechnics or universities of applied science.

6.703 Kranenburg In what is called fachhochschul education (polytechnics) I don't really believe that anything can be taught very efficiently, because this implies that there is a knowledge gap somewhere which you just have to fill. That is also the problem with e-learning. But you need the problems, the view, and the process.

Six of the interviewees are in favour of design education in an academy setting also called master classes, studios, or ateliers, and often offered in a post-graduate setting. The first three - Kipcak, Ehn and Heufler - themselves educate within such a setting.

9.102 Kipcak I believe the academy (master classes) approach is the optimum for learning to design. There is some theory, some basics, and there is freedom where people can develop. As a teacher at the Vienna Academy of Arts I had the most interesting experience and my students turned out to be successful after that.

9.104 Ehn The design studio or atelier is very important for all design education, and combining that with doing real projects with real people in the real world. In many ways it's like the old construction of a design school like we found it in early Bauhaus in the 1920's. Trying to find projects that are socially relevant and combining our own technology in the studio work. To me that is very much the ideal model.

9.109 Heufler At this college of course the training to become a practitioner is in the foreground, whereby we try not only to train restricted specialists in industrial design, but in a certain sense integralists as it is called; that is, specialists in the design speciality, but with the ability to include all possible areas. That is a fact because design has to include marketing, construction, ecology and economy. - Our programme is aimed mainly at the training of practitioners.

Domenig who has taught at a university criticises two things that happen at least in Austrian universities: the lack of access limits which go hand in hand with a maximum class size and the lack of time limits in education.

9.106 *Domenig* I cannot name the ideal school, but I can say what does not work. I have been active as a full professor at Graz Technical University for twenty years. After that I quit this position for the following reasons: When I started to teach we had 1080 students and 48 teachers (professors and lecturers). When I left we had 2500 students and 50 teachers - a ratio of one teacher to fifty students. In this situation you cannot educate the students individually, you lose the personal contact. More than this, I did not have time to work any more, not even with the help of my assistants (lecturers) whom I had trained to follow my own value judgements. In Austria unfortunately there are no time limits for students. That is why many people simply do not pass the exams for basic lectures or seminars, but continue studying for years. In Germany you have to pass the first diploma (similar to bachelor's degree) after two or three years. If you do not pass you have to leave the school. So I like teaching, but not under the conditions at Austrian universities which do not work any more. I was a visiting professor in all European and some American countries. Really good schools are never oversized. They have a limited number of students and there can be permanent individual contact and feedback to the students. Austrian students are not bad, but they have too much time.

Raby analyses the age at which students apply for a post-graduate programme and the optimum duration of this study.

9.105 *Raby* After their bachelor's degree people do a year out in practice, and then they join our course at the RCA (Royal College of Art). So we have two batches actually who come in. One batch comes in after one year, who are about twenty-one to twenty-three years old, and then we have another batch who have spent more years in practice and who come back at the age of twenty-seven to thirty. So there are usually two levels. But they all mix together and usually forget. It used to be a three years course, when I was there it was the last time. It became two years then. All the students complain that when they get to the end of the second year, then they could do a project. They all go: „Now, I understand!“ (astonished, enlightened exclamation) But I think it would take them probably another year, and they would go again „Now, I understand!“ (laughs) You know, the second year is so much stressful, because they are under so much pressure, they have to make decisions, and I think their decision-making makes them move quicker. Even if they complain „Now, I understand, and I want to do one more year“, I think that two years is probably good.

Zimmerman discusses some issues related to American post-graduate education or specific for Carnegie-Mellon University, namely the background of people who apply for studying interaction design and interdisciplinarity. While he works at a university I added his statement to the academy cluster as the group size and the access limits are most similar to that European model.

9.110 Zimmerman Well, I think for interaction design which is a masters programme - at least where I am it's taught as a masters and people can get a design-specific PhD - I think it's nice that our students come from a variety of backgrounds. There are a lot of people from writing backgrounds who are interested in understanding how design affects the content, and interested in the relationship between particularly image and text or linear and non-linear presentations of content. I think really that anybody who has an interest in content and technology could find themselves being pulled into interaction design but some basic visual training, whether it's like in theatre, just what things look like on the stage, film-making, photography, graphic design, industrial design, architecture, even mechanical engineering that's more focused on object making. Any of these are very appropriate backgrounds and I hope that interaction design keeps drawing from a variety of backgrounds, it's certainly drawing a lot from psychology, people with undergraduate degrees in psychology are coming back because they want to make things. And I think that's what really strengthens it. I think trying to create a major would create too many people with the same background, but the strength is to have so many people from different backgrounds.

Finally there are four interviewees in favour of the (European) model of university education. Gruber, Gründler, and Hirschberg favour unlimited access to the institution and to the courses, which is a core element of the Austrian university model assured by law. In Germany where Szyszkowitz is teaching the access is unlimited by number but there is a minimum average grade from high school required. In addition Szyszkowitz favours a maximum class size for his courses or for whom he is tutoring theses.

9.101 Gruber University is an unsurpassed learning institution for everybody, because as a student you can act independently from economic pressure.

9.111 Szyszkowitz The university model is a good kind of education for me, at least in the way we try to do it. Of course if I had 120 students per year this would be too much, but we set a limit of 30.

There is an important difference between Anglo-American and central European academic culture which is pointed out by Gründler.

9.108 Gründler I am a fan of the university didactics school by Klaus Horn. Also I am oriented to the Anglo-American academic culture and literature, which is more focused to the reader, there are problems and solutions. German books have extensive content, but novices will not understand them. Authors want to present an important contribution. American books are more customer-centric. My colleagues say they do not cover everything, which is correct. But this is not the goal of a coursebook.

Hirschberg describes why he is in favour of the specific freedom and pluralism offered only by universities with free access and a wide range of lectures. Also he is the only interviewee who mentioned the notion of research in this context.

9.107 Hirschberg I like working at the university because I see this playing with ideas and with ideal ideas and with the "first principles" that I mentioned, as the ideal form of education. I really think, that it is the freedom that the university offers, that we must make use of at the university, that we must preserve; otherwise we could really say why study. One can be trained as an architect by just working in offices and learning the job from the beginning on in this way. That used to be common, we cannot say anything against this method of training, there are great architects who learned in this way. I do not think there should be an obligation to base the training on practical work, naturally we should not separate ourselves completely. It is clear that one should have a connection to what is happening on the practical side.

9.107 Hirschberg At the same time we should try to fill this freedom of university education with good things and really use the difference of the university compared to practical work, that one can learn things, that one could never learn in this form in practice. A great freedom has developed through the new media, we can simulate, try and test, in a way that was not possible before. To try something out in architecture one had to build something. What we learned at the university was always a bit dry. We could only develop projects that stayed on paper. I think this has really changed with the new media. We can really work without being affected by any economic conditions that force you to compromise; to really think things through, to try them out, and therefore we can attain a much bigger, much faster, and much stronger gain in knowledge in the students. Therefore I

do not think much of a too practical direction in the education or training. Research also benefits from digital media and it will have a strong influence in our discipline, the tools for this should also be taught. Leading people to research is an important responsibility that I would like to fulfil.

9.200 Question 47 For the ideal kind of education or training, are there concrete examples of schools that represent it or come close to it?

As mentioned before the ideal way of teaching for van Kranenburg is „scholae“, a model which he tries to implement at a small postgraduate course with one mentor, eight students and one mentoring day per week.

9.203 Kranenburg My mentoring day in Antwerp is Friday, so every Friday we meet and have a cup of coffee, and then I go with every one for a walk. Every walk takes an hour or so, half an hour, three quarters of an hour. We walk around the park. There are eight people, so it takes a day. (laughs) We do this every week. Sometimes the individual walk only takes half an hour, and then we have a group discussion. Either we have a performer coming in and doing things, or we do a small task like the task that I described.

See the chapter on education methods for more details on Rob van Kranenburg's way of teaching and for the description of the exercise task in creative writing and project handover.

9.202 Kipcak The Academy of Applied Arts in Vienna.

While Kipcak favours an academy where he used to teach, Gruber does not prefer a small school to the university which he both experienced as a student.

9.201 Gruber I had the chance to study at Cooper Union in New York, an extremely small private school with 120 students. It was a hobby for people like Peter Eisenman or John Hayward to teach there. Small schools have the problem that individual teachers or movements dominate. Small schools have the advantage that tutors can help individual students better. Big universities have the advantage that the pluralism of movements and opinions is offered. It is hard to say what is ideal.

Heufler names a few schools which are all of the academy type.

9.209 Heufler There are concrete examples. I think that it would be a bit presumptuous

to consider our school as the ideal one. There are naturally schools in foreign countries, which we greatly admire and from which we definitely also learn. They are schools like the College of Design in Offenbach, that has achieved great things in the theory sector or is still achieving them, or schools like the Royal College of Art (in London), or (the College of Art and Design in) Pasadena in California. Therefore there are quite a few concrete examples.

Pelle Ehn describes his school in Malmö as of the ideal type, but he also points out the challenges related to this.

9.204 Ehn In our school, we started as a green-field operation from scratch at the end of 1996 and had the first students in the autumn of 1998. So we are very much formed in this way. We had all the constraints like not enough money to do all these things. It is difficult to say what is the ideal place. There is the Interaction Design at the Royal College of Art in London, there is the Interaction Design master class in Ivrea in Italy, there is the ITP programme at the School of the Art in New York, there is a very interesting programme in creative industries at Queensland University of Technology, there is quite a number of environments. We all have different conditions to work under. The challenge lies in find ways in balancing more traditional design, art, architecture competencies and practices with the practices we have at universities. It is not an easy task. It is a constant struggle and it should keep on being. We talked about it as the third culture. It is not something that is „there“. If it works, it has to be constantly re-created. This is very much the ideal for me, this third space where the third culture can develop.

Fiona Raby describes the unique concept of the Royal College of Art where she works but also two other architectural schools in the UK and their way of education. She is in favour of the atelier process of education because of the small number of students.

9.205 Raby Yes, in the whole college there are no BA students at all, there are only master's students. It is a very tiny college in that respect. In terms of architecture education, there are some very strong schools in the London area, like the AA (Architectural Association) and the Bartlett in particular that are amazing schools. So the RCA is very different, because most architecture schools have the undergraduate and the post-graduate and the part three examinations. So if you want to become an architect you start here, you do this and then you do this. I remember when I was in architecture school in year one, I was seeing people in year five and being terrified. That is the course, it is this runway. But if you are going at the RCA it is not like that at all. It is special in

its simulation of architecture, it is on the edges, it allows people who would not normally, people who want to pursue a different way of looking at architecture. It is a specialised area for architects who want to work in a broader arts context. So I would not say it is ideal, but as a teacher it is. I absolutely love my teaching with the students, it is a phantastic experience, we all do it for love and passion - because we don't do it for money - and I don't know if I could cope with..., I would not be able to teach bigger numbers. I am not a teacher, I am a practitioner actually. In many ways the atelier process of working with someone in practice is what it's all about really. So in many ways I don't regard myself as a teacher at all.

Hirschberg presents a detailed argument on why he is in favour of the university model. He emphasises the importance of new media which connect groups of students and their tutors and therefore allow better co-operation and supervision which before would not have been possible with this class size.

9.207 *Hirschberg* I have mentioned Media Lab a couple of times. To balance things out a little I should mention, as an example, the way we taught and did research in Zurich. In both institutions, that represent a target direction for my work here in Graz, research and teaching are strongly related, and there is a hands-on approach. This is not the very academic research, but a type that really shows concretely, that is then also tried out by the students. And that this knowledge leads back to research, that often teachers and researchers were united, this is an example for me and I also use it here. - *KB: From the students' point of view, would it be an academy model or a very open college, where one is free to choose the courses one takes, or a very business or economically-oriented school with a strict school character and relatively short (study time)?*

9.207 *Hirschberg:* I really think that by the way we integrate the students by networking they gain enormously as they are at a big university. It is my opinion that they can learn more than they would at a small elite school because they have a lot of colleagues. Therefore when one takes a strong interest in what the others are doing it is very positive. To open up, to link-up world-wide, education is not exempt from this trend. And it is clear that in the development of advanced projects the ideal form is where one can work intensively in small groups. I think we have an ideal set-up here. We have the big lectures in the basic education and together with this in the "No Lab" we have the possibility to work intensively in smaller groups in the design. I think the students have ideal conditions here at the university, one has the freedom of the university, it is less like school than other

colleges that structure their courses. At the same time in courses like the ones I offer...; I think in some areas this is seen as a deficit, that the comparison between the individual courses or what the students do between themselves, that this does not exist and this is a disadvantage. We are trying to compensate this in that we will give prizes to the best master thesis projects and we organise critique sessions (final crits). I simply believe that this gives added value, to experience from the richness, were is one standing, what else is there; not only to learn from one's own project but to learn from the others. In this sense not everything has been reached in Graz; I would say that we really try in my discipline. Also in the rest of the faculty efforts are being made in the direction I imagine. - KB: *This means that presentations of work by students to the group is probably a prerequisite for this type of learning?*

9.207 Hirschberg: Correct. This is generally common at the department of architecture. But it is usually mainly for the design group – that is sometimes 15, sometimes 30 people, but not 150 – this would not be possible. Due to this we compensate by using electronic media, so one can call up each student's work from his "instant portfolio". There is complete coverage in the courses that we organise, it is used and the students evaluate each other. The students are very positive about this, they value it a lot. I think that this would be good if it was also available for the basic education. I learned about this at the ETH. It is however, the more school-like model, which I would not necessarily transfer here, but the interesting thing about what a student could see at the exhibition in the art rooms at the school, every student could see what all the others were doing, and this seems to be a great advantage. We do not have the space for this. We can partly compensate here by the use of new media, by networking, but it is a chance, that a tertiary education institution of this size has, to be taken into account. This would be the ideal form of education here.

9.300 Question 48 *Please explain why you made this choice.*

Van Kranenburg adds some important aspects of his way of leading a master class. The contact day is not the only effort he does as a tutor but preparation and e-mail threads take a lot of time. Also he reports of an explicit conflict between teachers of different types of schools.

9.303 Kranenburg I don't know whether my way is ideal in a sense of an example for every teacher. Of course, I am trying to do my best, I am trying to create forms of working. But they

take an enormous amount of time. My first online course which I taught in Amsterdam, it took me 70 hours a week. So I was ten hours a day I was working on this course. I could not publish on this, because other people would say I am crazy, right? Other people have families, and they have to think about other things, too. I can be a teacher full time stop. I have to be really careful about what is my own need to teach, which is this 70 hours of work. How can I talk about the 20 hours of work. Because when I lecture teachers, first, all the teachers hate you, right? Either they come from university or from a postgraduate or from any kind of course where people think that you can talk about things and have time, which is not really true. But when I talk about e-learning, they invite me sometimes to come over to talk about e-learning, or to set-up e-learning environments in schools or so, and when you come in they hate you of course, because they think it is just more work and that is right: It is just more work for them. But then, I really try to give some good and concrete examples (of how it works).

Kipcak adds a problem with master classes which stems from the fact it is centred around one person only.

9.302 Kipcak I described the positive aspects before. The problem with the Academy is that everything depends on one person, the leader of the master class.

As we will discuss later-on in the chapter on future trends Gruber points out the big influence of (mainly technological) change we are facing today. Similar to van Kranenburg he is against a pure job training.

9.301 Gruber It is important that students have the possibility to do experimental things. The training should not be too focused on their future jobs. Job requirements change quickly anyway, so when you finish study the job you aimed at five years ago will not exist any more. So we need to give a broad unspecific education.

Raby continues her description of the properties of architectural schools in the UK. She discusses the advantages and drawbacks of a foundation year at the beginning of a course.

9.305 Raby The Bartlett is a very different kind of school, very aggressive, very competitive. We all feel guilty because their students work so hard. Our students work hard as well, but they work silly hard, where sometimes I do not think they have got enough time to think about what they do. Really, they just work and produce the most amazing, exquisite work. That is a very different

architecture school. Nigel will probably be a bit more critical about it, I don't know. We are all very passionate about what we do. That's why he is retired now, but he is still there hanging around.

9.305 Raby As Gillian Crampton-Smith is married to (the architect) Phil Thibault, she is used to an architectural approach, and during all the years there was the discussion, should we have a unit system in CRD (Computer-Related Design, now: Interaction Design, at the RCA), but because it is so small - there have been less than twenty students - we never managed to do it. Gillian was always interested by the idea of a unit system because it gives a certain kind of energy, but then you have different streams of education. In a unit system I get six students, first and second year, and the two of us (the tutors), we decide on the programme. Our students come with us the whole year and we do the programme. Yes, that's like master classes. Gillian looked at that idea.

9.305 Raby But because people are from so radically different backgrounds, and because they all need to learn of each other's skills, we always thought about doing something called „foundation year“ which you do in art colleges. Which means you learn about all the different art things you can do. You do a bit of painting, a bit of car styling, you try out lots of different skills and then you find where you wanna be, and then you do your three years. So Gillian also thought about the idea of a diploma foundation course where you would learn some skills that you did not have before. Maybe that would be the way. And then you join the unit system and you pursue a line of thinking. I think that would work in Interaction Design. But in a two year period it would not work, because by the time you have learned your skills and understood a bit more about the diversity of the system, there is not enough time. (In interaction design) they do that, they split up. So all the first year students work together, and all the second year students. That is the difference. So they would have their first year projects, and the second year projects, so first year's don't get to work with the second year's so much. Whereas we (in architecture) cross the two - we have the first and second year's students working together. You should definitely talk to Gillian about that, and about the relationship between architecture and interaction design, because she has thought a lot about that.

Comparison with own education:
Was it different? What is better / worse now?

- ☒ Yes. I studied at the same university where I work now.
 It was very different. Now teachers are more motivated. Students are more critical. More feedback from students. Gru
- ☒ Yes! We have now: Learning by doing, motivation,
 learn essentials not details. Students can express themselves. Grü
- ☒ Yes. Media design was only done by autodidacts.
 Now students are more pragmatic. There are less visions.
 In 1970s utopia dominated. Kip
- ☒ Yes. I am doing it better now. / Today's students are so instrumental.
 I am an anarchist. Kra
- ☒ Yes. Tremendous difference between traditional university
 and new school of arts in Malmö. Ehn
- ☒ Yes. New media did not exist. ETH Zurich course is more structured,
 limited, competitive. Hir
- ☒ Yes, drastically. Difference between mass university and
 individual training in small groups. / We wanted to create a
 training that we would like to have received. / Small groups
 are better. More practical emphasis. More commitment of
 lecturers. Permanent challenge. Too much? Heu
- ☒ Yes. My experience from improvisational acting helps:
 How to build and use tension. Zim

unanimous:

"YES my education was different" 8 of 8

→ Design education is in a period of change.

Table 25: Comparison with own education.

9.400 *Question 49* Does the education or training you offer fundamentally differ from your own one?

This is one of the very few instances where a question has been answered by all eleven interviewees in a unanimous way. All of them said that the education they offered is indeed different from their own education. There is a number of reasons for this. The value of open discussions between students and tutors is repeatedly mentioned.

9.401 *Gruber* Yes, my own education at Graz Technical University was very different from what we do now at Graz Technical University.

9.404 *Ehn* Yes, very much. Before we set up this school in Arts and Communication in Malmö I was a professor in Informatics at Lund University, which is an old university from the 15th century. Even students of today who were both there and then at our school say that there is a tremendous difference between that traditional university and the environment where I am now.

Van Kranenburg complains about his students being so instrumental while he rather was radical as a student.

9.403 *Kranenburg* Well, actually, I think I am doing it better. (laughs) But that is because I really want to and think about it. But the situation in itself is not really better or worse, but I think my university students, New Media students, are so instrumental. It is incredible. I am more of an anarchist than they are. I am the one who has been a..., no I am not subversive of course, not even a radical, I am a salon-radical of course, but I talk about art marginal, anti-globalism. I invited Naomi Klein, took her to talk to my students in the New Media Lab, and the first three questions she got were about branding! (laughs) So there she sits and my students talk about branding! (laughs) Which is of course very good, and I like it, and it is ok, it was funny.

Raby thinks that her students may be overstressed by the amount of work at her school.

9.405 *Raby* They have a day with us, they have humanities on Friday mornings, they do lots of computer things, I think Tuesdays and Thursdays are studio days, Friday mornings are humanities, and they do something on Monday. Wednesday is their free day. The number of seminar hours depends on the term. A lot of tutors come in and do the technical things with us and them.

The dissertation starts to come in a bit later. So they may be overstressed, they have got lots of things to do.

The main differences for Kipcak like for Hirschberg are in the creation of new media. Kipcak also mentions organisational issues.

9.402 Kipcak When I was young, media design was a field for autodidactic experience. But I was an autodidact as well as a student of architecture. I was an active member of a self-organised student group within the university, which was a good basis for self-development in freedom and good for studying in a creative discipline.

Hirschberg's argument is similar to what Domenig stated earlier about the long medium study time of Austrian students.

9.407 Hirschberg The education that I offer differs from my own as I said. The new media did not exist in this form when I was a student. I also did not study here but at the ETH (Swiss Federal Institute of Technology in Zurich) where the whole course was much more structured, where the length of study – these students who get their degree after 20 years was not possible there, one was finished in more or less 10 semesters and because of this we had less freedom. I partly see this as an advantage because there is a strong comparison to the others. It was also very competitive. There was a big drop-out rate at the examinations etc. It is definitely different to here, but some of it is the comparison to others, and one could definitely take this on here.

Gründler considers his students as his customers which illustrates his mindset is different from many professors in earlier times. Also he reports of the big change in discussion culture and structures.

9.408 Gründler Yes I hope so! I try to motivate my customers to learn by doing. They should learn essentials and not details. They should have a right to express themselves. But democratic structures in universities are currently demolished, if I compare it to the 1970ies. On the other hand I was not allowed to criticise my teachers when I was a student. In new Austrian polytechnics, there are no democratic structures that involve students and lecturers.

Heufler explains what has been his vision when creating the study programme he leads. He and his colleague actually always see the education with the eyes of the students and compare their school with their own experiences as students.

9.409 Heufler Yes, drastically. Although I must say that I definitely also learned a lot at Graz Technical University, there is no question about that. The contrast is: there it is a mass university and here an individual training in small groups.

9.309 Heufler My colleague Gerald Kiska and I were able to shape and structure our programme and curriculum very strongly. And, on the one hand, we started out from the negative experiences in our own education and, on the other hand, the positive examples that exist, and tried to develop a training that seemed personally the best. Actually we wanted to create a training that we ourselves would like to have received.

9.500 Question 50 *If yes, what are the differences? What has become better or worse over time and why?*

Gruber sees a general increase in the quality of education.

9.501 Gruber Nowadays the teachers are much more motivated to offer good lectures. Also the students are more critical than they were 20 years ago. Today there is more feedback from students to teachers.

As van Kranenburg stated earlier also Kipcak complains about the fact that visions, ideals and utopia have been lost again in the last two decades.

9.502 Kipcak It is different. The students' attitude towards their discipline has become much more pragmatic. The unrealistic utopian implications of design that dominated in the 1970ies to the mid 1980ies do not play a role any more. Maybe this will come again. Maybe the lack of visions makes it worse today.

Both Raby and Heufler see the size of seminar classes as an important factor. Like Raby mentioned earlier also Heufler believes that the pressure today may be too high for the students.

9.505 Raby Class size: The particular schools for architecture I mentioned, they still manage to keep small groups, I think it is fifteen people, it is still manageable. I think in undergraduate it is different, they have bigger numbers in the classes, and I do not know how they do the undergraduate, but postgraduate has still smaller numbers.

9.509 Heufler The group size is better now, and the practical emphasis is much bigger. Then also the commitment of the lecturers. The Technical University has many lecturers who have tenure of office, that have the same level of education as when they started, they have not developed. Here at the college (FH) a permanent challenge dominates. Perhaps the pressure for the students is a bit too high, here we are looking for ways of deceleration.

A very personal and unique advantage is explained by Zimmerman who has a background in theatre. I believe that already at high school theatre or drama is much more valued and trained in the UK and the USA than in continental Europe. This definitely brings an advantage for the students in terms of their ability to talk in front of big audiences. Some training in improvisational acting would probably improve every teacher's skills dramatically.

9.510 Zimmerman I would say for me one of the best things I bring to my students comes from my experience doing, as an improvisational actor and director, and that as a student I never experienced, except when taking drama courses, I never experienced teachers with this. I think that is one of the best things I bring to my students, particularly in the area of how to communicate your idea and how to read an audience in that demonstration so you're really getting the idea across how to handle tension, create tension, break it. I think that's a nice skill that I can bring to them, but I don't think a lot of other interaction designers have that and I'm not sure they need it. But it's the best thing I offer my students.

Grading and evaluation

When we want to evaluate design solutions we face three difficulties as enlisted by Lawson (1997: 63): „First, the various criteria of performance are not likely to be equally important, so some weighting system is needed. Second, performance against some of the criteria can easily be measured while in other cases this is more a matter of subjective judgement. Finally, we then have the problem of combining these judgements together into some overall assessment. (...) Somehow, then, designers must be able to balance both qualitative and quantitative criteria in their decision-making process.“

Lawson (1997: 65) elaborates that when trying to evaluate or compare design solutions we often have to rely on numbers and counting systems. There can be a numerical system like length where a ratio between two numbers is defined. As opposed to this there is no ratio defined between two temperature measurements, because 20°C is not twice as hot as 10°C. This is called an interval scale. Similarly, a subjective assessment on a scale usually having seven intervals does not imply that a rating of four is twice as usable as a rating of two. On ordinal scales a sequence, ranking or order is displayed, but the interval in terms of performance between two numbers is not necessarily equal. For subjective ratings, it sometimes makes sense to use an interval scale. When the assessment may depend on many factors it may be better to use an ordinal scale, however. Academic marks are on a scale of one hundred, but degree classifications are on an ordinal scale of first, upper second, lower second, third and pass. Finally, in a nominal scale, numbers are used as names and cannot be manipulated arithmetically.

Academic marks are on a scale of one hundred, but degree classifications are on an ordinal scale of first, upper second, lower second, third and pass. When we ask people to assess alternative designs by placing them in order of preference, these rank scores are ordinal numbers. We cannot add the scores given to every design to determine the winning one. In the middle of the twentieth century theoreticians in both psychology and design tried to treat their disciplines as scientifically respectable by applying numerical methods to them (compare Lawson 1997: 67f).

„Universities use external examiners to help protect and preserve the ‚absolute‘ value of their degree classifications. It is, perhaps, not too difficult for an experienced examiner to put the pupils in rank order. However, it is much more difficult to maintain a constant standard over many years of

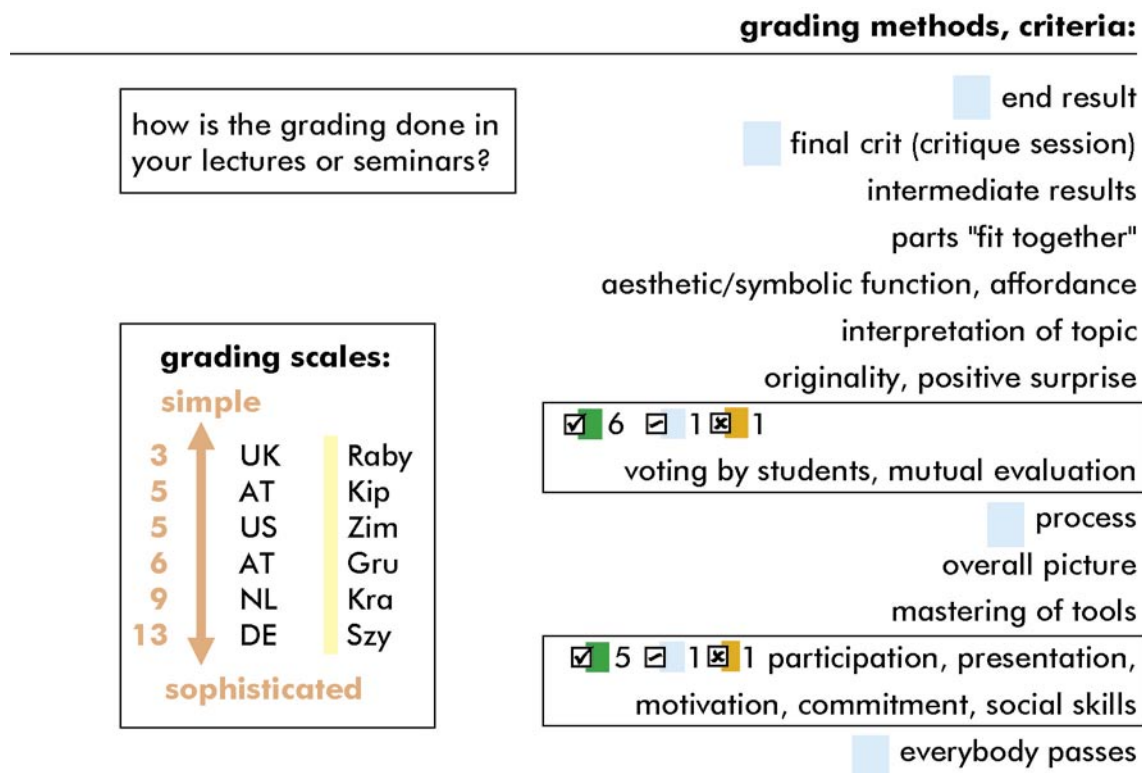


Figure 26: Grading methods

developing curricula and changing examinations. It is tempting to avoid these difficult problems of judgement by instituting standardised procedures. Thus, to continue the example, a computer-marked multiple choice question examination technique might be seen as a step toward more reliable assessment. But there are invariably disadvantages with such techniques. Paradoxically, conventional examinations allow examiners to tell much more accurately, if not entirely reliably, how much their students have actually understood.“ (Lawson 1997: 69)

„Currently it is fashionable to produce simple, some might say simplistic, measures of performance. So schools and universities must be assessed for the quality of their teaching and research. There are some dangers associated to this approach. However, assessing the research done in departments of design is an even more tricky problem. How on earth do we evaluate the output of artists, composers and designers in terms of their contribution to knowledge?“ (Lawson 1997: 121)

Lawson (1997: 227) points out that „as a teacher of design students I have seen more design mistakes than most and in many cases they result from the designer falling into a mental trap which it is relatively easy to learn to avoid.“

Grading and evaluation

Is it possible / does it make sense to grade design skills?		
<input checked="" type="checkbox"/> 7 yes		<input checked="" type="checkbox"/> 1 no

Is it possible to do objective evaluation of design quality?		
<input checked="" type="checkbox"/> 3 very hard		<input checked="" type="checkbox"/> 2 no

Is objective evaluation of earlier works of art possible?		
<input checked="" type="checkbox"/> 2 yes	<input checked="" type="checkbox"/> 1	<input checked="" type="checkbox"/> 2 no

Figure 27: Grading methods

- 1) The category trap: „The most obvious trap (...) is to identify the problem by the category of solution most commonly found.“ (Lawson 1997: 228)
- 2) The puzzle trap: While a design problem has no correct answer, designers treating a part of a design problem as a pseudo-puzzle can be trapped into believing at implicit rules that they fail putting into question. (compare Lawson 1997: 231)
- 3) The number trap: It has to do with the mistaken use of criteria established to ensure good design. (compare Lawson 1997: 235)
- 4) The icon trap: It can happen that the visual effect of a drawing is in the way of a good end product. „There is nothing wrong in producing beautiful presentations, so long as they continue to do their job of revealing and communicating the design so it can be properly understood and thoroughly examined.“ (Lawson 1997: 237)
- 5) The image trap: It happens when the designer has a wrong image of the final design held in his or her mind, or if there is a mismatch between intention and realisation. (compare Lawson 1997: 237)

„Over the years I have listened to many hundreds of design students telling me in their crits how their designs will look, feel or what they will be like to live in or use. The natural and perfectly understandable inexperience of the design student means that quite often they are just plain wrong.“

An architectural student may intend a design in a certain way, „but their design may be a great disappointment if constructed. All too often design students and some of their tutors (...) are content to have the ideas without testing the realisation. (...) Such students can be taken to the laboratory or made to do some calculations and be confronted with the results. However, what becomes rather more problematic is when the image in the designer's mind is about some form of social reality.“ (Lawson 1997: 238)

There are many parallels between Lawson's remarks from architecture to interaction design and usability engineering. However, in the computer-related disciplines testing and evaluation are much more common, so ratings and numerical representation of quality is a prominent issue to be dealt with. As soon as the factor of design comes in there is the same problem with evaluation than in every other discipline.







10.100 Question 51 How is the grading done in your lectures or seminars?

The interviewees report about several different approaches of grading. The simplest way of grading is certifying participation (Gründler) or by assignment of „pass“ or „fail“ and prizes as done by the Raby.

10.108 Gründler vvAt the University of Arts there are no grades, just a certificate of participation. At the polytechnic there are grades and a practical and theoretical exam.

10.105 Raby That is a difficult one because the college decided not to put distinctions. They used to have distinctions, and they decided not to do that any more, so you either pass or fail. But then they give prizes, so certain students get prizes, and we all fight who they should be. It is a difficult thing. For me it changes. You know, one week one project is phantastic, and next week another one's project has taken over. There are definitely very talented students, and there are obviously some who are talented in different ways, so it is difficult. So, we don't evaluate at the end but we evaluate all the way through. But also we have crits or critiques. Because we are dealing with a quite ephemeral, intellectual way of working. It's really important that students communicate, so we force them to go in public. They have to present in front of everybody, hang their drawings on the wall. They have to give a reason why they have done what they have done, how they have done it, and to do it publicly. It is quite stressful. They have to prepare it and make decisions, which is

How is the grading done in your lectures and seminars?

Not any more distinctions, only pass/fail, and prizes.	3	UK	Raby	
Grading in 5 steps from 1 (very good) to 5 (failing).	5	AT	Kip	
US model: grades=points: A=4, B=3, C=2, D=1, F=0 (failing). Average and ranking is done, e.g. "I have 3.5"	5	US	Zim	
Grading in 6 steps from A (excellent) to E (failing).	6	AT	Gru	
Average grade 8 or 9 for motivated students. Best grade = 9, worst passing grade = 5.5	9	NL	Kra	
1 to 5 scale with subdivisions: 1.0 - 1.3 - 1.7 - 2.0 - 2.3 - etc. - 4.7 - 5.0 (failing). Grade plus written verbal evaluation to differentiate.	13	DE	Szy	

simple

sophisticated

Table 26: Grading methods

very important. We force them to do more. So what we would normally do is to invite outside people to come in who have nothing to do with what we are doing. Also we get the students to write 150 words about their work.

At different times during her interview Raby gave other details about presentations of students' work and final critique sessions.

3.405 Raby Project documentation is a thing that we force them to do for crits. Before the critic comes in, we get a text of about 150 words from every student about what they are doing. So we send it off to the critics, and when the critic comes I can at least read it to be prepared. Because a lot of architects do not know what Tony (Dunne) and I do. So it is helpful for them to be able to understand a little bit by reading those descriptions of about 150 words.

13.305 Raby (...) Most of the architecture schools run in the unit system way. In Bartlett they have something like twenty-five different studios. They have something which I hate actually: The tutors present their students' portfolios for the exam. Not the students can stand for themselves and speak up, but there tutors do, so I would have to go and justify. But my interpretation of my

students' projects is radically different from their interpretation. What do they know, what is their understanding, not what is your understanding. I find that contradictory. (...)

In Austria grading is done on a five steps scale from 1 (very good) to 5 (failing). Kipcak points out that the students themselves set their targets.

10.102 Kipcak By assignment of grades. – In general the success of a piece of work is given if a student reaches the goals which (s)he has set him/herself at the beginning of the project. An exception can be in case of a very ambitious idea that fails due to unforeseen circumstances: In this case the wish can stand for the work.

In the USA a six steps grading scale is used.

10.110 Zimmerman Generally grading in the U.S. is letter and numeric simultaneously, so students get a grade of A, B, C, D, or F. Different schools have different F's – whatever they call it – for „failing“. And those grades convert into points. An A is 4 points, a B is 3 points, a C is 2 points, a D is 1 point and an F doesn't count. Then it's just a matter of computing a mean score and that's how students represent themselves. They say „I have 3.5“ meaning they have roughly half A's and half B's. And it's a way students are ranked against each other.

Recently some universities in Austria switched from the five steps to a six steps grading scale.

10.101 Gruber We try to spot every student during the whole term and give the grade for the overall picture consisting of several small steps. Also we invite experts to final crits. This can be problematic because they do not know the history of the presented work. Grading is done in 6 steps from A (excellent) to E (negative). It is recommended to give all available grades in the system (e.g. from 1 to 5 in Austria, or from A through E, or from 10 to 0). Giving only verbal feedback is not enough, but it is very valuable in addition to the grades.

In the Netherlands a nine steps grading scale with intermediates is used. Van Kranenburg already stated earlier that he is against grading. As far as possible he acts according to this belief and uses the grading system in his own way. He elaborates on the roots of the problems with grading and participation which are not only caused by the teachers but also by the students themselves.

10.103 Kranenburg I think that grading is very important. I am teaching an entire group of 80 third year's graphic designers at the arts academy. So the first thing that I always say in the begin-

How is the grading done in your lectures and seminars?:

<input checked="" type="checkbox"/>	Continuous evaluation. Final critique sessions with external experts. 150 words statements by students. At RCA students present, at Bartlett tutors present students' work.	Raby
<input checked="" type="checkbox"/>	Grading is not very important, but giving good feedback is important. Everybody has own way of designing. Quality is always visible. Grading is subjective. Complexity and holistic approach are valued. Copying ideas via the Internet is a problem.	Dom
<input checked="" type="checkbox"/>	Completeness evaluation of deliverables. Teachers compare individual results. Consensus is easily achieved. Social skills are valued. In group teaching with five teachers, all teachers evaluate whole pool.	Hir
<input checked="" type="checkbox"/>	Whole semester motivation and commitment, intermediate result and end result.	Heu
<input checked="" type="checkbox"/>	Whole term overall picture.	Gru
<input checked="" type="checkbox"/>	Final crits with external experts.	Gru
<input checked="" type="checkbox"/>	Whether student reached the goal set by him/herself.	Kip
<input checked="" type="checkbox"/>	Announces at beginning of course that everybody has passed. Presentation and performance by every student once per term. Criteria: product, process, promise. Does not want people to work for a grade.	Kra
<input checked="" type="checkbox"/>	Free attendance did not work. Now mandatory.	Kra
<input checked="" type="checkbox"/>	In general against grades. Students require it. Tries to see design skills and product as whole.	Ehn

Table 27: Grading methods

ning is that everybody has passed the exam, so they know it before the exam, because I just hate getting questions about how will we do the exam. So I say, this is what we do, Nigel and I. We have sixteen weeks. We will take the book „A technology of arts analysis“ where we take the concepts like curiosity and cruelty. Every week we talk about these issues and somebody will give input. The others can all sit back and relax.

10.103 Kranenburg And everybody has to do a performance any time they want. And I say you don't have to come. I do not want to force you, we are all grown-ups here, you are all working already, some have their own company, but when you go to school, you slip into this puberal sixteen-year-old mode, you go completely passive and receptive, because they are not challenged. Well, of course, half of them dropped out immediately and did not show up the next time. This was so bad that we had to re-install the constraint that attendance was mandatory. They would have liked to attend the lessons, but they did not have the time. Nobody has time. I thought it was so childish, but it is the only way to force them, and they ask for it themselves. It is really the last time that I will try to discuss this issue of mandatoryness. We will just make it mandatory.

10.103 Kranenburg But what I will do is to say, if you participate and if you listen, if you will do a performance, you will get an eight or a nine. You are third year graphic designers, you have skills and projects and stuff, we cannot grade like this any more, right? You can grade yourself. What I would really want is to get rid of these grades whatsoever. The institution has to do it, so I have to do it, but I really, really hate it. So I give points really for motivation. I had troubles at the university because I was giving nines, there were also people that I supervised, and there were two instances where I had to put it down to an eight, because the second reader was not going to give a nine. I could understand it to a certain point, but my grading of theses is product, process, and the third one is promise. The promise that he or she shows when she goes out. Think if you leave with a piece that has a nine, it is a motivator. So why shouldn't you give it, why should you just hackle on those eights? I give nines, I only give the best one.

10.103 Kranenburg The worst one with which you can pass is something like 5.8 or 5.5, I don't give those grades, because I think, you might not try again. But it is very important that the grading is very clear before the course. If the grading is not clear before the course then you get an enormous amount of noise in your group. And that is why you take away this noise if you say, everyone gets his grade, everyone passes, when you just work, you pass. And then I want you to talk about the good work yourself, and I do not want people to do this for a grade.

The most sophisticated system is reported from Braunschweig University in Germany where a 1 to 5 scale with two intermediate grades per interval is used which means 13 different steps. Szyszkowitz also explains the importance of verbal evaluation.

10.111 Szyszkowitz Theses as well as seminar papers and designs are graded according to a system based on the (Austrian) school grades that range from 1=very good to 5=insufficient, but enhanced by three further subdivisions per grade. So our scale is 1.0 – 1.3 – 1.7 – 2.0 – 2.3 - etc. – 4.7 – 5.0. With this scale we can differentiate very well. We use the whole range of grades. Also I started to add a verbal (written) evaluation to the grade, so I can express a lot of things. For example if somebody will get an average grade which is in the range from 2.3 to 2.7, this grade can only be differentiated and justified by some additional text, like: „Great idea, excellent concept, but not elaborated correctly, not pursued till the end, not enough consequent.“ The student will be reassured by the fact that his or her ideas are great and if he had done more work it would have been ok. Or another example: „Extremely diligent, excellent work, beautiful drawings, highly sensible, but poor concept.“ The student will know that he or she should have taken more time and effort for the concept. So the text will give everybody a second chance, even the lazy one will get a chance because the text will say: „You are a lazy one.“ In this sense the text is much better and a more powerful tool compared to the simple grade.

Heufler explains that at his school grading is not only based on the end result but also takes into account the whole design process.

10.109 Heufler The grading is done, on one hand, over the whole semester; especially concerning motivation and commitment. And also the grading of steps in-between. And then of course, with the greater portion, the end result.

Ehn had already elaborated on grading in the chapter on group work.

3.404 Ehn It is also a good question. Ideologically we started that we would not do an individual grading at all. But as it is now at the undergraduate level, I cannot say how the scheme is at the moment, but we always give individual feedback, not only group feedback. So every student has a meeting with the tutor once or twice per semester where they get individual feedback on their own work. – The individual student all over the semester will have meetings where the teacher will talk about his or her work. It is very interesting that the students have been asking for individual assessment and we did not have that idea. Also in group work some students get upset by the fact that there are students who do not contribute very well, but we say it is a problem for the individuals who are not contributing very well. But there is this tension.

10.104 Ehn KB: *You have already indicated that in general you are against it but you have to do it and students require it. Does this also apply to "Gestaltungs" (design) skills or the outcomes of design?* – Ehn: This is a good question. I could imagine that students have different opinions about it, but in the master class and the PhD level class we try to see it as a joint, as a whole.

Domenig has already stated earlier that there is a problem with copying from the Internet. For him grading is not an important issue and often he gives all students of a class the same grade.

3.406 Domenig Grading was never important for me. It is not interesting for me. Usually I give the same grade to all students, sometimes the best grade to all of them.

10.106 Domenig I do not have a problem with grading. Like I said earlier, everybody has his or her way of designing. When a piece of work is done, it has a certain quality or it does not. Even when design principles are used that are different from my own ones, I can always determine whether there is some quality or not. I have said that grading is not so important, but in contrast it is important to give good feedback to every good piece of work. I always declare that it is my personal opinion. If there is a certain complexity and a holistic approach, this should be reflected in the grading as well. Gestalt is an important dimension in architecture.

8.306 Domenig (...) Something which is really difficult is to prove to a student that he or she has copied an idea from somewhere else. Today there is the Internet which allows the students to search for a specific topic like school buildings or museum buildings. So the student can copy projects or ideas worldwide via the Internet. Maybe the teacher does not know the original, but it is still possible to check this. At the end of the day every student is self-responsible for the quality of the education and whether he or she does some work.

Hirschberg points out that grading can result out of a co-operation of five lecturers in a team who are tutoring student groups in parallel in the same topic. This shows that a good organisation system and communication between lecturers is essential in case seminars are given in parallel. Like in a design project the management effort will increase dramatically as soon as one person can not do it alone any more.

10.107 Hirschberg Due to the fact that I normally stretch the lectures over the semester and I categorise the subject matter into individual exercises, there is usually a relatively high transparency. In the individual case we can only evaluate what we have got, i.e. the completeness of the

deliverables. This results in a picture, where one can relatively objectively...; objective evaluation of performance does not exist. There is simply a consensus between the lecturers – this is also as we do it: we get together as a group and discuss the comparison of the individual work, who deserves what grade. It is always surprising for me, how easily we achieve a consensus. It is important for me that people who are very social and who contribute well during the lectures, that their work is also rewarded in the end. In this way people are able to compensate, when the results do not look so good. – *KB: How many lecturers take part in such a grading session?* – *Hirschberg:* Those who have taught (in the basic education), initially there were five of us in a course of 130 students. Relatively, it is a lot of work – one has to take a few hours of time to get through everything. Normally it is the lecturers who were involved. – *KB: This is one project and five lecturers that take part in your course in this project, or do I not quite understand this?* – *Hirschberg:* No, this is a course, whereby all the exercises are co-ordinated, so that the same exercise is taught by different lecturers. An exercise is a type of creative project. Where it is able to be seen by all, and without having belonging to a group as an emphasis, and it is then handed in. It all lands in the same pool and is evaluated by all together. Although in theory according to TUG Online the specific lecturer is responsible for a group and could do the grading – in this case it does not seem to make sense. We all sit together and evaluate all of them. – *KB: Therefore there are five courses in parallel dealing with the same topic.* – *Hirschberg:* Correct. There are five groups doing the same course. They are individual courses that have the same topics.

10.200 Question 52/53 Do you think it is possible and/or does it make sense to grade and evaluate design skills? If yes, how do you grade and evaluate design skills in your lectures or seminars?

There is an interesting difference to be noted between Gründler's opinion from music and the others' from design. But a comparison between fine arts and music would most likely not show this difference, so the conclusion would be that grading makes sense as long as there is an application-oriented product to be done.

10.208 Gründler In music composing or sound design I do not think that aesthetic quality should be graded. It should be graded only whether the student has applied certain design principles or guidelines or whether the student has done a lot of efforts. What I would not grade is the general aesthetic approach of the piece. A student can have a completely different kind of aesthetics than I have.

Is it possible / does it make sense to grade design skills?

If yes, how?

<input checked="" type="checkbox"/>	Yes it is possible.	Szy
<input checked="" type="checkbox"/>	Yes. Give only tasks which teacher can grade or evaluate.	Gru
<input checked="" type="checkbox"/>	Yes, possible and makes sense. Check whether design corresponds to briefing (by students). Other formal criteria.	Heu
<input checked="" type="checkbox"/>	Yes, very important. In first year a difficult transition: All were top 5% of high school, but not so in college. MIT switched to pass/fail for first year. Written evaluations cannot be used elsewhere. I do grades and written feedback (craft, design thinking, presentation).	Zim
<input checked="" type="checkbox"/>	Yes. Final critique sessions also with non-architects. Teaching partnership with balanced skills (theory/practice). Exchanges for crits with teachers, practitioners and artists. Verbal feedback. Crits in first and second year. Continuous contact with tutor can detect or prevent problems early. Structured review of what was shown. Way of working.	Raby
<input checked="" type="checkbox"/>	Evaluation by group of students, e.g. everybody gives one point.	Gru
<input checked="" type="checkbox"/>	Intuitive approach, several aspects contribute: artefact, process, contextual sensitivity, experience design. Verbal feedback from tutor. Kind of crits with potential customers or users.	Ehn
<input checked="" type="checkbox"/>	Never objective, but makes sense. Possible with consensus of lecturers. Electronic evaluation by students (plus/equal/minus). Democratic principle.	Hir
<input checked="" type="checkbox"/>	Yes, not for tutor, but for students. Reason for decision needs to be transparent. Only uses passing grades 1 to 4, not failing grade 5 (students should not come back).	Kip
<input checked="" type="checkbox"/>	Not in music. Aesthetic quality or approach should not be graded, because it is individual. Only grade whether student applied design principles.	Grü

Table 28: Grading and evaluating design skills

The educators in architecture and design all believe that grading design skills makes sense indeed.

10.211 Szyszkowitz Yes it is possible. I already explained the reasons earlier.

Gruber mentions the interesting didactical approach of having some evaluation done mutually by the student groups.

10.201 Gruber Yes it is possible and necessary to grade design work. Or I should say it is possible to give only tasks which the teacher can grade or evaluate. Grading is a long-term task. Also people have to learn to accept being graded. The same work can be graded better in a different context. – It is an interesting exercise to have evaluated students' work by the group of students. This should happen in a transparent way. A procedure would be that every student can give a point of appreciation to one other student's work.

Similar to Szyszkowitz also Kipcak uses a combination of grading and verbal evaluation.

10.202 Kipcak Yes it makes sense provided that the reason for the decision is communicated. For me grading is not very important, but I learned that it is very important for the students. From the scale used in Austria („1“=best to „5“=not passed) I only use 1 to 4, because I do not want bad students to come again in my seminar. – There is a final presentation by the student. After that there is a discussion where I give the grade and explain the reasons for my decision.

As Kipcak stated earlier also Heufler uses the briefing or target set up by the students themselves as a basis for his evaluation of a project work.

10.209 Heufler Yes, it is definitely possible and it makes sense. I can only answer that with yes. – The evaluation can partly be based on the briefings drawn up by the students themselves or on criteria. – *KB: You check whether the students met their own goals.* – *Heufler:* Right. For example during project work they make a target group definition in the form of mood boards. Then at the end or also during the project it is asked if the design corresponds to these suggestions that are found in the mood board. Does it correspond to the briefing, that was practically created by the students themselves? Then there are also criteria that are drawn up by the lecturers, the quality of the mockups and such things.

Ehn and Raby elaborate in detail on the organisation of final critique sessions which have two goals: defining the grades and giving feedback to the students about their own and the other students' work.

10.204 Ehn KB: So when you grade a design project, do you grade just the outcome or also the process, or even the intention or the idea that was there? – Ehn: I have an intuitive approach where several aspects contribute. There are things you can measure for instance whether an artefact works or not, but there are so many other things. The process is also very important and the contextual sensitivity to what has been done, there are so many more aspects like the design of the experience etc. – KB: Are there crits, critique sessions once per project or does this depend on the level? – Ehn: It depends on the project. We have maybe not crits, but feedback from the tutor or supervisor or teacher of the project. – KB: Are there regular meetings during the project? – Ehn: During the projects we have meetings typically once a week, it could also be more often. There would be a kind of „handleitung“ (guidance) typically once a week or every second week. – KB: So in a typical project you would have one or two contact hours per week. – Ehn: Yes, one hour. But the teachers are always there in the research studios, the results are quite open. This is for the masters students. It's more difficult with the undergraduate because there are so many. But there are also scheduled meetings. – KB: In the crits, is there just you or are there also other people who participate? – Ehn: At the end of longer projects we also try to invite some of the potential customers or the potential users, like for example people from a hospital when this was the topic of the project.

10.205 Raby For the crits we also invite non-architects. In the first term we try to get people who are involved with the research, more artists, philosophical people, journalists, people who are dealing with current ideas of contemporary society today. Those people are good for discussing ideas now, so we get them in the first term. The second term goes materialwise, so we try and get people who are used to making things and thinking. In the last term we get more architects in to discuss houses and what are the architectural references. My teaching partner is an architect, you know a real one – not like me – he is practicing in architecture, so we have this balance between us, I am more the theoretical and design-orientated one, and he is more..., well he is not practical either, but he deals with planning applications, and the stuff of architecture, so that is our team work. So we get in the crits and we write notes about what the critics say. The presentations take a whole day.

10.205 Raby We have minimum of two critics. We usually beg and borrow and steal, because we do not have a lot of money. We buy them a nice lunch. Sometimes we do exchanges, for example I am going for a crit for them. We try and get more critics. Sometimes they are teachers as well, but we try to get practitioners in, and artists, a mid-room mix of people. The critics give direct

verbal feedback and all the students are there in the process, so it is very public. Students pass at two points: One is in the first year and there is one before they are in the second year. But because you write reports twice a term, and if there is any problems, something is going wrong, you start to connect with them and find out what is going on, so you get concerned. So if this is in the first year they have the possibility to change studio and blossom in another studio, or maybe there is a difficult problem, and sometimes students take a year out. Sometimes we get them when they are a bit too young, and they can do it with a bit more time. So it is all a bit fluid. But there is no kind of evaluation – it is on each other. At the end, those who have done well know that they have done well, and the other students see it. There is a lot of peer-pressure. Students are a bit quiet and shy in the beginning. We encourage them to give feedback to each other as well.

Hirschberg explains the interesting participatory system he uses in grading at the introductory courses and where the students can mutually evaluate themselves. The process is supported by a web-based platform. Evaluations by tutors and students have the same impact.

10.207 Hirschberg As stated it is possible with a consensus of the lecturers. It can never be objective. It definitely makes sense. I also stated that we promote the students to evaluate themselves. We have this principle that each student has a voice and each lecturer has a voice and we have a system of "plus, minus or equal", one can click onto this and collect points. But one can change it at any time. This means that one cannot vote five times, it is all registered in a database. I can only always make one evaluation for someone else's work, but I can change this at any time and it is accumulated. This serves a bit like a filter for the students – how am I doing? And we usually start from the beginning with this, that the students evaluate the work of other students. It is a completely democratic principle where we do not have a bigger say than the students (who evaluate each other) themselves. We also have an exercise there – I am always talking about the basic education here, about these design methods, the basic course, that we do in the first two semesters – here we let the students decide between themselves which layout will be compulsory for them for the final work; not to be seen as a rigid layout, but as a layout principle that they can then use, such as font size etc.; just an example that they also evaluate each other.

Zimmerman raises an interesting issue that appears in the first year of study. A large part of the students will face a deception because of getting lower grades than in high school. He also gives written feedback in addition to grades.

10.210 Zimmerman Yes I think it's tremendously important to grade but I want to qualify that and offer an example. So for our students the first year is particularly difficult because generally they were maybe in the top 5% of their high school and there's no way they could all be in the top 5% of their college. This is a very difficult transition and I'm not sure if grading the first year on someone's permanent record is helpful, and I know that MIT has switched to pass/fail for the first year to address this problem. But I think grading later is very important because the students need quite accurate feedback. To draw as another model that I think is successful: Sarah Lawrence College in the U.S. doesn't offer grades but written evaluations from the teacher for each student but the problem with this is translating that so that when students apply for a higher level of education and they can't quantify how well they did. It's very difficult to convince someone of how good of a student you are. - What I do with my students is a combination of both: Grades and written feedback. They get grades and written feedback in the areas of craft, design thinking and presentation.

10.300 Question 54 *How do you evaluate and grade master theses and/or doctoral theses?*

Kipcak and Zimmerman state that the best two grades are used for the evaluation of theses.

10.302 Kipcak Similar. I did this at Graz Technical University. I only had good students and nearly always gave a „1“ (best grade on a 1 to 5 scale), only one time I gave a „2“.

10.310 Zimmerman It is the same system as I described before, although anything less than a B is a failing grade.

Even more than for project work the evaluation of theses can involve co-operation and discussion between lecturers.

10.307 Hirschberg When supervising master and doctoral theses we usually also discuss this between ourselves. I am often alone, but it depends. But I always find it difficult to evaluate them completely on my own. I often consult the lecturers who were also involved.

There is a range of criteria used in evaluation.

10.309 Heufler With master theses there is a whole catalogue of criteria, whereby the criteria are made known to the students beforehand.

How do you evaluate and grade theses?

Similar than in seminar. ■ Input from different people. Decision not on feeling, but on criteria, e.g. for a poster: readability, emotion-provoking, content, story.	Gru ■
■ Similar than in seminar. Usually good grades on 1 to 5 scale.	Kip ■
Discussion between ■ teachers. Possible but difficult to do it alone.	Hir ■
■ Catalogue of criteria made known to students beforehand.	Heu ■
Same system as for ■ seminars, while anything less than B is failing grade.	Zim ■

Figure 28: Grading methods

10.301 Gruber It is similar than for seminars. However it is important to get input from different people. We try to apply criteria and not decide on our feeling. E.g. if you design a poster it needs to be readable from a certain distance, it needs to initiate emotion, it needs content and a story - so you can evaluate whether it meets these criteria. We do not use taste or emotion for grading.

10.400 Question 55 How do you evaluate a design outside your lectures or seminars, e.g. when you are part of a jury?

In design the co-operation and discussion between experts seems to be central to master the challenge of evaluation of a piece of work.

10.407 Hirschberg In evaluation of performance in competitions I always think that discussions with experts make the final judgement.

If somebody does the evaluation job alone it makes sense to increase objectivity and comparability by an individual standardised category system.

How do you evaluate design as a member of a jury?










Becomes a  routine job.	
See what are roots of piece of work, orientation, ambition.	
Jury decisions are often  unanimous.	Kip 
 Discussions among experts.	Hir 
No complicated point systems.	
 Short briefings of 5 to 7 criteria made public before are essential.	
Competition result is separate from education.	Heu 
Create individual  standard to compare items.	
Method only relevant for oneself.	Zim 

Figure 29: Grading methods

10.410 Zimmerman I think individually you need to create a standard for yourself to compare things to each other. If I was trying to compare 25 poster designs or 25 different films I would need some method that I could categorise how well they did so I for myself can understand it. But the individual method I use I think would be very relevant for me but wouldn't necessarily be relevant for anyone else.

Intuition can play an important role in evaluation, which does not mean that there is necessarily any disagreement among the jury members.

10.402 Kipcak I have often been part of a jury, so it is a routine job. Jury members see what are the roots of a piece of work, after what it is orientated, whether the student has been succeeded to implement the ambition or not. Last year I was a member of the international Pépinière jury, and all the jury decisions were unanimous, as all the jury members have a long experience.

In a jury evaluation like in a final critique session objectivity is increased by the involvement of external experts and a set of criteria.

10.409 Heufler If they are competitions in which our students are taking part in, but were accompanied and supervised by us, there is an evaluation also by means of didactic criteria within the course, and the competition result is seen separately and independently judged by the jurors. This evaluation can also deviate from ours, because the path to a certain result can be different to

the end result. – *KB: If you are a jury member at a competition, is it really a decision based on feelings or do you also use criteria, or how can one evaluate it objectively?* – *Heufler:* I have been involved in many juries. Long, complicated point systems have not paid off. What has proved useful is short briefings; that are however, immensely important. Therefore one can take a number – from five to seven important criteria as guidelines and this is also enormously important. They have to be criteria that are known to the competition participants beforehand. Only this is fair.

10.500 Question 56/57 Does your approach to grading differ from other common approaches? / According to what criteria do you evaluate design quality?

Kipcak underlines his intuitive approach to grading.

10.502 Kipcak I do not think so. I already mentioned this earlier.

The criteria can vary quite strongly. Originality for example has been described by van Kranenburg as causing „terror“ while it is central for Gruber.

10.501 Gruber Originality and motivation is seen very positive in our institution. We value when we are positively surprised by our students.

The way of presentation of a piece of work can have an important influence.

10.504 Ehn (*A sentence is missing.*) Also projects are being displayed in an exhibition. Some of the projects are text-wise very good, but they did a very bad „Gestaltung“ (design) of the exhibition which is quite interesting. Of course they will have feedback on that. So, the potential of some theoretically very interesting work is not seen in the exhibition.

For Raby a whole set of criteria applies, some of them related to the end product and some to the design process.

10.505 Raby There is also a kind of continuous evaluation. I send them a review of what was said, so it is quite structured actually. We say: What was shown? The drawings that were shown, the arguments, the hypothesis they sent us. We then look at where the condition of their project is, the comments they have made. Then we say: What are the future goals? What other things they might try and look at? Then a feeling of how they have been working, whether they have been

What are your criteria for evaluating design quality?

Originality, motivation, positive surprise.	Gru
Common criteria.	Kip
Different criteria, including also presentation design.	Ehn
Categories and point systems can be helpful.	Hir
Not all criteria can be objectively evaluated. Apply criteria of target group. Criteria: aesthetic function, symbolic function and affordance.	Heu
Yes, you can evaluate it. Criterion is whether parts "fit together".	Szy

Figure 30: Grading methods

attending or not. But you know, we do not have that problem though, our students are very „hungry“. It is very rare that people don't show up. It is only once a week and they desperately need tutorials.

As design work is a very personal kind of expression, the evaluation of design work can always be interpreted as a critique of an individual. This issue can be dealt with by introducing criteria and evaluation categories.

10.507 Hirschberg My approach does not differ very much from other approaches. Sometimes it makes sense to divide into different categories. I also think of examination commissions that I was also a part of recently, if one differentiates between the candidates it is very hard to evaluate a person; as an aid the different categories are divided and there points are given, this can be very useful. At the end one comes to the realisation that the same result would have been attained if only one note was given.

Of course a system of categories and criteria needs to be carefully designed and used in order to avoid evaluation errors. Such systems will make the evaluation more objective but not necessarily make the juror's task quicker or easier.

10.509 Heufler I notice again and again, that naturally – as engineering is always very important to us – that not all criteria can be objectively evaluated, many criteria have to be evaluated subjectively. Because there are also functions that are very subjective. Symbolic functions often relate to the product language of small groups. For example, if a product is created for punks, then one must bring in criteria for punks. It would be madness if we were to use the criteria for higher management. It is easier in the areas of ergonomics, where there are only objective criteria, that one can judge correspondingly well. Therefore there will always be a certain leeway for insecurities. – With design criteria we again refer to the theory of product language. In design, as well as the practical functions that are mainly evaluated ergonomically, there are also the criteria of aesthetic function, symbolic function and affordance („sign function“), whereby the symbolic is the most difficult to evaluate.

An evaluation criterion is the thoroughness of the self-consistent design principle of a piece of art or design.

10.511 Szyszkowitz You can definitely evaluate design work, because every design has its own design principle, like every piece of art has its own self-consistent design principle, so its parts will fit together. In a painting by Cézanne, every small part fits together. These are design criteria. Everybody will build his or her own design criteria. So this is what you can evaluate and explain very well.

10.600 Question 58 *Do other criteria play a role in grading your students, like for example whether they actively participated in the seminar during the whole term, whether they asked questions, whether they were visibly motivated, e.g. by the form of their contributions like drawings, mockups, computer-generated prototypes, field research, exposés.*

Gruber does not take into account other criteria, or he rather considers them as part of the output.

10.601 Gruber No, because motivation and questions are not separate things, this will always be reflected by the quality of the output. People who ask questions will usually have the best results in their work. But the form of the work is central in architecture of course.

Do other criteria apply: participation, motivation, form of work















<input checked="" type="checkbox"/> 	Yes. Mastering the tools, interpretation of topic and material, energy.	Kip 
<input checked="" type="checkbox"/> 	Yes. Doing more than expected.	Hir 
<input checked="" type="checkbox"/> 	Yes. Active participation and questions.	Grü 
<input checked="" type="checkbox"/> 	Yes. Participation, commitment, questions. Presentation, documentation.	Heu 
<input checked="" type="checkbox"/> 	Yes, presentation to 20% (showing up, attitude, questions, behaviour).	Zim 
<input type="checkbox"/> 	Participation is valued, but a good result at the end is ok as well.	Szy 
<input checked="" type="checkbox"/> 	No, just quality of output.	Gru 

Table 29: Grading methods

Szyszkowitz takes an intermediate position saying that he values other criteria like participation but a good result at the end is ok as well.

10.611 Szyszkowitz We have a list of attendees for the seminars or „correction sessions“. I check whether I have seen a student in my lectures, which plays a role as well, or whether the students is here for the first time. There are lots of small questions which allow me to check this. However, if somebody does not attend the seminar and will submit some good result at the end, this is ok as well. But if I will not immediately see where to enter the building, I will not like the design, because it is very important for me to see where the entrance of a building is.

The other interviewees who answered this question stated to take into account the criteria mentioned in the question.

10.602 Kipcak Yes, these things also play a role. It is necessary that the student masters the tools we use and can interpret and design the full dimension of the topic and the material. The student's energy of interpretation and design is essential.

10.607 Hirschberg Especially those who do a little bit more than expected of them in a project, this definitely pays, those who do not just do the obvious, yes.

10.608 Gründler Yes, it is relevant for me whether the technology students participated actively and asked questions.

There are several criteria that can be included into the evaluation.

10.609 Heufler Participation and commitment definitely play an important role, also the asking of questions. I can only underline what is stated above. The quality of the presentation is also a very important factor, the conveyance of the contents of the total results (of a role), be it the presentation, the quality of the model and also the communication quality or the quality of the information content, the preparation of the documentation.

It makes sense if other criteria than the end result are recorded in a continuous way throughout the duration of the course.

10.610 Zimmerman Twenty percent of a student's grade in my class is called class participation. This is like showing up, having a good attitude, asking questions, not having your mobile phone go off, listening attentively when your other classmates are presenting - all of these things that apply to the whole group behaviour. These all add up, but again it's a very subjective model, how much I think they participate. I record these things throughout the year, but I don't necessarily record it in a quantifiable way, I just make notes.

10.700 Question 59 *Do you think it is possible or it would make sense to bring the evaluation of design quality to an objective level? If yes, how is this or could this be done?*

There is disagreement on this question among the interviewees who answered it.

10.702 Kipcak I think it is not possible to make this objective, but there is an implicit consensus on what is good and what is not.

10.708 Gründler I am not an expert in this, but I believe it is very hard to evaluate design quality. If you want to study music composition this is done, but it is very problematic if you want to bring it to an objective level.

Is it possible to do objective evaluation of design quality?






<input checked="" type="checkbox"/>	Very hard in most disciplines. Goal is not objective grading, but training students to be graded. Grades are important, verbal feedback not enough. A jury also gives few prizes, sometimes not justified. Grading is not important after all.	Gru	
<input checked="" type="checkbox"/>	Very hard. Done in music composition, but problematic.	Grü	
<input checked="" type="checkbox"/>	Possible in part only. Even students and lecturers got similar results. Better with bigger jury and external experts.	Heu	
<input checked="" type="checkbox"/>	Not possible, but implicit consensus on what is design quality.	Kip	
<input checked="" type="checkbox"/>	Not possible. Categorising into sections, discussion between experts.	Hir	

Table 30: Grading methods

10.707 Hirschberg The best way to reach an objective evaluation is by discussion between experts, partly if it is categorised into individual sections. However, it is not possible to be completely objective.

While Kipcak and Gründler see the lack of objectivity as a problem of the so-called soft disciplines like design or music, Gruber believes that it is a general one even in the more quantifiable disciplines. Nevertheless Gruber states that grading needs to be done.

10.701 Gruber In most disciplines it is very hard to bring evaluation to an objective level, even in disciplines like informatics. It is not our goal to make objective grading, but to show the students how problematic it is to evaluate. But the distinct grades (A to E) are important for us, verbal feedback is not enough. It is like in a jury decision – only a few people will get a prize. Students have to get used to being graded, and they have even to get used to getting grades which they perceive as not justified. In architectural contests there is only one first, second and third price, and three more works are purchased. That's all. Students have to get used to that small number of winners as well. After all, grading is not very important.

An interesting experiment is reported by Heufler who has compared the evaluation done by the students and by the lecturers and did not find any important difference.

Is objective evaluation of earlier works of art possible?

<input checked="" type="checkbox"/>	Yes. Field is codified, but difficult to know historic context. Needs specialised knowledge and empathy. Know on whose shoulders we stand.	Kip
<input checked="" type="checkbox"/>	Either apply today's standard or see whether product is a classic.	Heu
<input checked="" type="checkbox"/>	Only check whether criteria are met - based on group consensus. Criteria are not good basis for new work.	Grü
<input checked="" type="checkbox"/>	Not really possible. Influenced by culture. No lasting criteria, only state-of-the-art.	Hir
<input checked="" type="checkbox"/>	No, not necessary. Depends on interpretation and time. Criterion is success.	Gru

Table 31: Grading methods

10.709 Heufler Stated above: In parts it can be made objective. We have also done trials where the projects have been independently evaluated by the students and then by the lecturers, and the results did not drift far apart. It was rather astonishing. Or we have often also tried, that the evaluation is carried out by many people or the evaluation is enhanced by external experts. When we do project work together with a business, we evaluate the projects with experts from the company.

10.800 Question 60/61 In contrast to this, is it possible to objectively evaluate the quality of a design which stems from a time some decades earlier? Please explain! What could be the criteria applicable to this task?

Gruber states that an exact evaluation is not necessary but the marketplace will have the ultimate word on the value of an artist's work.

10.801 Gruber No it will never be possible in an objective way, because in every time we interpret the work of earlier times in a different way. But I think it is not necessary to evaluate

anything in an objective way. – A criterion for evaluation is success. Picasso or Andy Warhol can be considered as good artists because of their tremendous success, their publicity and their wealth. They had the intention to become super stars.

A similar statement related to architecture is made by Hirschberg.

10.807 Hirschberg The same applies to earlier works. Finally the way something is seen is always judged culturally, and culture develops; and therefore, there are no objective criteria that are unshakeable. – The criterion is always the state-of-the-art in building design.

In his balanced statement Gründler discusses the value of criteria. In contrast to what Heufler said earlier it can be a problem to make the criteria known before the design work is done.

10.808 Gründler This is only possible if you are willing to define a set of criteria, then you can determine whether somebody stucked to them. For the criteria there needs to be a consensus among a group of people. The problem with this is that students would try to use them to achieve good quality of design or music, which would be the wrong way.

Heufler and Kipcak agree with the objective evaluation of historic work under the condition that historic standards are used for evaluation.

10.809 Heufler On the one hand one could use a standard from the time we live in now. That is one possibility. The second way of looking at the situation would be to use the modern standard and then it would become clear if the product is a classic product or not.

10.802 Kipcak Yes, but in order to evaluate historic works of art we need to know a lot about history of arts and the historic context – which makes it difficult. On the other hand the historic field is already codified – which makes it simple on the other hand. This is a whole profession. One needs a lot of specialised knowledge and contemplative empathy. Training these skills is under-represented in many schools. It is important for a good designer to know on whose shoulders we stand.

10.900 Question 62 In your lectures or seminars, have you used the method of evaluation done mutually by the students themselves? Or have you used this as a cross-check for the students with your own

Do you use mutual evaluation by students?		
<input checked="" type="checkbox"/>	Yes. Students' evaluation skills are trained. Young method: circular project handover, popularity rating, statistics. Teachers' grading criteria transparent.	Gru
<input checked="" type="checkbox"/>	Yes, self-evaluation gave mostly same grading as by tutor.	Kip
<input checked="" type="checkbox"/>	Yes, some mutual group assessment, teachers' evaluation. Academic process is defense and mutual critique.	Ehn
<input checked="" type="checkbox"/>	Yes. Academic process is discussion at same level. Train students' ability to evaluate.	Hir
<input checked="" type="checkbox"/>	Yes, valuable as a cross-check and to train evaluation skills. Also some grading is anonymous.	Heu
<input checked="" type="checkbox"/>	Yes, in "correction sessions". Teacher explains work and grades, discussion possible. "You can stay with your building and show the entrance to everybody." Students learn most from each other.	Szy
<input type="checkbox"/>	Group work is not graded but criticised by all students.	Grü
<input checked="" type="checkbox"/>	No. Students mutually grade participation, but not work. Students evaluate teachers anonymously.	Zim

Table 32: Grading methods

evaluation in order to train the students' evaluation skills? If no, do you think methods like this could be valuable or interesting?

Similar to Heufler also Kipcak already has positively tested whether his own evaluation matches the evaluation done by students.

10.902 Kipcak Yes, I once asked the students how they would grade their own work, and their answer was correct in most cases. We should not underestimate their ability to be self-critical. For me grading is not so important. But why not, if somebody asks for it.

Gruber sometimes uses the method of mutual evaluation by students and considers evaluation as a part of what students need to learn. Raby earlier called this the ability to do value judgements. It is an interesting approach to make grading transparent in order to give the students the possibility to learn from it.

10.901 Gruber Yes we sometimes have evaluated students' work by the other students. Evaluation is even part of what we want them to learn, because it is difficult. The method is young and not yet perfect. I described earlier the method of circular handover of projects. Students give points to the others' projects and select them as a basis for their own further work. We do popularity rating and statistics, all in a transparent way. Also we make the teachers' grading criteria transparent and we welcome discussions on our grading.

Hirschberg and Ehn both favour open discussions and a low perceived power distance between students and lecturers.

10.907 Hirschberg I find it very valuable to include to students in the evaluation process. I have also tried in such discussions – whereby I experience this as normal at the university – one does not have this authoritarian relationship to the lecturers, it is always a discussion at the same level. In this sense I definitely think they are valuable. This is the ability to evaluate, that one would also like to train the students to do, they should also take part in discussions.

Ehn also reports of teachers' evaluation by the students which has also become mandatory in Austria a few years ago and has also been mentioned by Zimmerman.

10.904 Ehn We have some group assessment. And then the students assess the teachers on the different courses. That is a kind of a formal procedure, they basically fill in a scheme. And there can also be feedback sessions, but we are required to do a formal feedback. - Students typically comment on other groups' work after the crit. And it could also be as part of the exam. So more in the academic format: At exams you would both defend your work and do a critique on someone else's work.

Heufler points out the advantages of anonymous evaluation.

10.909 Heufler This method has been carried out. – It was successful. When we do it, it is always only as a cross-check. The problem often arises that a few students feel unfairly evaluated. Then we do another cross-check, anonymous of course, so that individual prejudices do not become apparent, but one gets a group grade. - Certainly, methods like this are valuable and exciting. – *KB: So it is probably possible for the people who evaluate to teach the ability to judge – not only for those who are being evaluated.* – *Heufler:* Exactly. Or what is also done, for example, the results of the seminar "principles of design" are presented anonymously, that is, handed in; so that there can be

no accusation that one has preferential students, but it is done like a wine-tasting. This is definitely valuable.

Szyszkowitz reports of the so-called correction sessions which are taking place in the middle of the project. He also explains that he requires a building to be self-explanatory.

10.911 Szyszkowitz Yes of course. We do this in our seminars or „correction sessions“ that I already explained. Everybody needs to attend because they all can learn a lot. The students only learn from each other. More than this, I will not always have to repeat what I said. I hate this if I have to repeat everything. At the end there is a big session where all students present their work that is already corrected and graded by the teachers. I will present the results and I will explain what we liked and what we didn't like. Also the students have the possibility to say something about their work. For example if a student will tell me that I did not understand what he or she intended by this design, I will say: „Is this my problem? Maybe this is your problem. Maybe your intention is not clearly visible. In real life your building will stand there on its own. You would have to stay there and show every visitor where the entrance is. Then, it will be ok.“

Gründler and Zimmerman both use a kind of feedback and critique by the students which, however, does not have an influence on the grades.

10.908 Gründler When we do group work in the seminar, the results are discussed with all students. It is not graded, but sometimes questioned and criticised by other students.

10.910 Zimmerman No. The students grade the participation of their team-mates but they never grade each other's work, at least not in my class. But what they do, and I think it's maybe even required by law in the U.S., is that they grade me and their grade of me is publicly available at the university so anybody that's choosing my class can see what people have thought of it in the past and it's actually very valuable information and all the teachers have to work hard to make sure they get good grades as well. This is quantifiable but then in addition it's verbal. A quantifiable grade is what people can see, like I got a 4 or a 7. But in addition students write comments and it's anonymous. Actually I give them the forms to fill out and then I have to leave the room. I don't even pick the forms up, I never see them again. Somebody types it so that there's no way that I can tell unless I recognise somebody's word selection. And it's done at the end of the year, so I don't see the results until after grading. I get the written comments back and I use that to help me redesign my course.

But with a quantifiable score, they rate both me and my class like the content that I'm teaching, to see if it's even a relevant class, and that's publicly available and tracked over time and certainly influences my tenure at the university.

Access limits to schools

Access limits are definitely an important issue because at this moment an important decision on the future of a person is taken. While the decision on whether an applicant is accepted for a school does not necessarily determine his or her life it nevertheless can have some important impact. In this chapter the access limit systems in different countries and the interviewees' opinions in this issue are compared.

11.100 Question 64 Are there access limits to your lectures or seminars or to the whole study programme? If yes, please explain.

The free access to Austrian universities is ensured by law. Exponents of Austrian universities are Domenig, Gruber, and Hirschberg.

11.101 Gruber No there are no access limits at Graz Technical University.

However, also at Austrian universities there is an increasing number of access limits to seminars because of limited space and tutoring resources, like reported by Domenig.

Are there access limits to your seminars or school?	
<input checked="" type="checkbox"/>	7 yes
<input checked="" type="checkbox"/>	2 partly
<input checked="" type="checkbox"/>	1 no

Effects of access limits:	
<input checked="" type="checkbox"/>	2 fully ok
<input checked="" type="checkbox"/>	6 partly
<input checked="" type="checkbox"/>	1 not ok

Figure 31: Access limits

11.106 Domenig There are no access limits to the university and to my lectures. However, there are limits to my seminars, where we work on the quality of the design work they do, because I cannot deal with hundreds of people at the same time. We would lose the personal relationship. More than other professors, I always focussed on good selection and training of the tutors or lecturers, who are an important component of my work as a teacher.

This is in contrast to Austrian academies of art and polytechnics (FH) where Gründler, Heufler, and Kipcak teach.

11.108 Gründler Yes, at the university of arts and at the polytechnic school there are access limits.

11.109 Heufler Of course there are. The study programme is limited to 18 students that we can accept every year. There are about 100-140 applications.

11.102 Kipcak There is free access to my seminars, but there is limited access to the school.

A similar situation is reported from the USA by Hirschberg.

11.107 Hirschberg In my courses at Harvard there are naturally strong access limits. There was always only a small chosen flock that were given permission to study. And there were always limited places for the courses. And one could choose the people depending on this. This is much less the case here.

At German universities there is a certain minimum level of grades from high school required for every study programme. At Braunschweig university there are also limitations for the access to thesis supervision.

11.111 Szyszkowitz We need to keep a maximum limit of 30 students (per semester, per project, for diploma theses). We would not be able to do more. With more students the quality of our teaching would decrease. I have five to six teaching staff. Every project is taken care of by two tutors, so 30 students are taken care of by two tutors and myself. Another two tutors and myself will take care of another 30 students, which makes a total of around 120 students per semester.

The entrance assessment is a delicate issue for two reasons. First it is important for the individual applicants, but also the overall result will be important for the profile of the school, like reported

Are there access limits to your seminars or school?

<input checked="" type="checkbox"/>	Yes, to the school, based on portfolio, written exam + interviews.	Kip
<input checked="" type="checkbox"/>	Yes, to the school, based on grades from high school. For master and PhD level based on portfolio and interviews. Arts teachers want creative students, teachers with academic background want students with potential.	Ehn
<input checked="" type="checkbox"/>	Yes, for architecture based on portfolio and interviews. Want to have broad range of personalities. Age does not matter. For interaction design a richer mixture between disciplines.	Raby
<input checked="" type="checkbox"/>	Yes at university of arts and polytechnic.	Grü
<input checked="" type="checkbox"/>	Yes to the school.	Heu
<input checked="" type="checkbox"/>	Yes, my course is limited to 18 students. CMU also has access limits based on high school grades, letters of recommendation, written standard tests, portfolio.	Zim
<input checked="" type="checkbox"/>	Yes, diploma theses limited to 120 per semester.	Szy
<input checked="" type="checkbox"/>	Not to university, but to my seminars. Good selection of lecturers.	Dom
<input checked="" type="checkbox"/>	Yes at Harvard, not in Graz.	Hir
<input checked="" type="checkbox"/>	No.	Gru

Table 33: Access limits

by Raby from the Royal College of Art. An interdisciplinary mix of students will ensure a pluralism in discussions and project work. As stated earlier students learn a lot from each other and not only from their tutors.

11.105 Raby Gillian Crampton-Smith was choosing for interaction design. She would obviously choose more carefully, because they would come from an architecture background, but in interaction design, she would choose particularly to have a mixture between very technical people, people from psychology backgrounds and others. In architecture we just have architects. Having said this, we take interior designers as well. So we do have a balance between the two. But it is a bit simpler, it is not so rich as you might have in interaction design.

Besides the grades from high school and an interview with a jury there is often a portfolio of design works required like reported by Raby and Ehn. Obviously not only the school will choose their students but also the students can be in a position to choose between more than one school.

11.105 Raby At the RCA there is no entrance exam, but a portfolio is required. They basically get an application form, they have a reference, they send a portfolio. All the tutors go through the portfolios. We get over a hundred for twenty-four places. Yes, that is just in architecture. It is school by school. Other courses are animation, graphic design, illustration, car styling which is hugely popular – it is international, fine arts get like two-hundred portfolios for twelve places. We work that down to a half, then we interview that half, we get them to go through one of their projects, we look about how they think about their work, how they discuss it, we ask them questions, what they want to be, what they want to do, why they like to come to the RCA. We do try and make a balance, we do not just choose amazing people, we always try to have a combination of characters and personalities. Obviously we want to have good people, but in the end we love to have personalities, people who are somehow strange. So we have a few wild cards every year. It is quite intensive, it takes a bit of time to make a selection. And they are choosing us as well, because they could go to the Bartlett or to the AA or to other places. Age does not matter, everybody is treated the same. But it is nice to have a broad range. We do tend to have a broad range.

Ehn points out that it is not easy to select students for a design programme based on their marks from high school. After a few years of study it becomes easier. There is also an interesting difference between the priorities set by the teachers.

11.104 Ehn Yes, there is at the beginning a consideration of the grades from high school. For the master level the access limit is a portfolio of the student's work and interviews. This is the same for PhD students. At master and PhD level the school is an elite school. The students who come can show and demonstrate by their portfolio that they are able to do creative works and hopefully also have reflective skills. In that sense they already come in as persons that have already demonstrated competence. On the undergraduate level it is different because the way that we have to recruit students is by their marks from school. Those with the highest marks come in and you have no idea what their creative skills are. So it is interesting enough to see that those among the teachers who have an arts background usually want the best, the most creative minds to get in, and their intention is not so much to develop creative competence. Teachers who have an academic background usually are a little bit different, they rather want students who have a potential to develop.

As there is a wide variety of skill levels set by high schools, in the USA there are some standardised tests that contribute to a better comparison of individual strengths and weaknesses. Also letters

of recommendation are taken into account and - similar to what has been mentioned above - the portfolio plays the most important role.

11.110 Zimmerman There's a prerequisite to my course called „communication design fundamentals“, but in addition there are other restrictions. I can limit my class size to make it artificially smaller than I'll teach, so certain students with a certain major, meaning they have a certain background, get in first and then I pick and choose from the wait list and there's a lot of selection of students that I think can succeed in my class and have that underlying skill level. You can do it when you're looking at 18 students, but with a class of 200 it would clearly be overwhelming. - In order to become a student at CMU in general, they have to apply to a specific college at the undergraduate level, and in the college of fine arts they have to actually apply to a school, so design, art, architecture are all separate applications. School of computer science is a separate application. - As an entrance exam there are several components that you need to apply to an American institution: You need to have completed your previous education or high school diploma for undergrad, you need letters of recommendation which are very considered. And there are two tests: There's the ACT and the SAT which students are generally required to take one or the other, most students take both. I believe the abbreviation SAT stands for Scholastic Aptitude Test. - It's not like an intelligence test, but it's like a general knowledge test. Students across the whole U.S. take it, so it's a way of measuring, standardising. At the graduate level there's a test called the GRE, Graduate Requirements Examination or something like that, which is topic-specific as well as general. So it's like general verbal skill, general math skill and then topic-specific, but it's a lot less important generally where someone got their degree from, at a college and the grades they got and the recommendations are much more important. Also for design there's a portfolio requirement which is critical. You have to have a portfolio and that's probably the most important thing for design students.

At Austrian polytechnics for design the entrance criteria are the marks from high school, a standardised written test in various skills like logic reasoning, three-dimensional perception, language understanding, and design-specific issues. The most important factors are again the portfolio and the interview by the jury.

11.200 Question 65 What do you believe is the effect of access limits? Would it be preferable to have them or not?

In their position toward access limits there is a wide spectrum of opinions again. Ehn and Heufler are in favour, Gruber is against them and the rest of the interviewees has a somehow balanced opinion for different reasons.

Like discussed earlier Gruber's opinion is that there is no specific talent required for studying architecture. Therefore it is understandable that he is against access limits because any entrance examination would be irrelevant under this condition.

11.201 Gruber In general I am against access limits. There is no precondition or talent necessary for studying architecture. Also we cannot define any criteria, because in contrast to other disciplines the field of architecture is very wide. Access limits are not good, especially in the context of a very open and interdisciplinary study programme. For a design discipline there is no specific talent required like e.g. in music.

Ehn would like to do an entrance exam rather than having to rely on the grades from high school. The core element of the selection process would be a letter of application.

11.204 Ehn This is much better than grading. Yes this is ok. On the other hand it would be very difficult, as we accept only 200 students. But on the level of undergraduates you could not do this as more than 2000 apply. So you would need something else. But we are actually not allowed to ask the students who apply to write a motivation, why they want to do this. We did it one year and it helped a lot, we got a much closer group that were motivated, because they had to do this work and think through: „Why do I want to follow this programme for three years?“

Heufler agrees with the current situation at his school where an entrance exam is done.

11.209 Heufler I think that it is of great importance that we have access limits for the following reason: The level of education should be as high as possible to supply a certain guarantee of work, a job guarantee in inverted commas. We know that very good designers are in demand. And if we can make a selection here, then it is an enormous advantage. Therefore (I am) definitely (in favour of) access limits.

While they are in favour of access limits Domenig, Kipcak, and Gründler report of some problems

Effect of access limits

<input checked="" type="checkbox"/>	Yes it is ok. We could not take all applicants.	Ehn	
<input checked="" type="checkbox"/>	Yes, very important to keep high education level, get job.	Heu	
<input checked="" type="checkbox"/>	Entrance exam makes sense, beneficial for all parties.		
<input checked="" type="checkbox"/>	Sometimes mistakes are made, good people are refused.	Kip	
<input checked="" type="checkbox"/>	We should not take everybody, we can not teach properly.		
<input checked="" type="checkbox"/>	Problem: people who show talent only later. Political issue.	Dom	
<input checked="" type="checkbox"/>	Yes for post-graduate course.		
<input checked="" type="checkbox"/>	No for general study, introductory lectures.	Hir	
<input checked="" type="checkbox"/>	Necessary for limited access. But often people change		
<input checked="" type="checkbox"/>	during study time. / Tell them how to prepare.	Grü	
<input checked="" type="checkbox"/>	Problematic but necessary.		
<input checked="" type="checkbox"/>	Takes time, hard to be objective with portfolios.	Zim	
<input checked="" type="checkbox"/>	Computer optimises assignments for diploma thesis.		
<input checked="" type="checkbox"/>	We do not have access limits to school, which is good.	Szy	
<input checked="" type="checkbox"/>	Against access limits.		
<input checked="" type="checkbox"/>	No criteria or talent necessary for architecture.	Gru	

Table 34: Access limits

with entrance examinations. It definitely seems to be hard to estimate the potential for design of a young person who has not received any design training. The same applies also to music.

11.206 Domenig There is a certain danger related to entrance exams and access limits, because there are people who show their talent only later in life. On the other hand you cannot give access without any formal regulation. So I believe that it depends on the political way of thinking of the people responsible for that. So as I said, if you take everybody, you do not show any responsibility toward the students whom you will not be able to teach properly.

11.202 Kipcak I think that an entrance exam or assessment makes sense. However, this is a controversial issue, but I think it is beneficial for all parties. The assessment is not to 100% correct, so sometimes I have seen good people being refused, so there may be mistakes in some cases.

11.208 Gründler My own experience is that students who are not so good at the entrance exam will often be excellent at the end of their study, and vice versa. This is an indication that it does not really correlate. Our programs take a relatively long time. In a period of five or six years,

people can change a lot. An entrance exam is only a snapshot. But it is necessary because access is limited. We need to justify a selection system. People should get the information how they can prepare themselves for the selection process.

Zimmerman as well reports of problems with access limits while he does not see any alternative.

11.210 Zimmerman There's all kinds of problems with it. Right now we're accepting students looking at portfolios. It's very hard when you're looking at maybe 60 or 70 portfolios, to be as objective on the 69th as you were on the first. So I wish we could do a better job and I wish there was a way to speed the process up, but I can't imagine another process that would work better right now.

Hirschberg is in favour of access limits for post-graduate courses, but not for undergraduate ones.

11.207 Hirschberg Is it good or bad? I think it cannot promote motivation in anyone. Of course it can increase the standard, if you have people that you have chosen beforehand. At the same time I really believe in these big courses, where a lot of good and bad students are studying together – this also has its qualities. – If it would be better with or without access limits depends on the context in which the question is asked. I think, in the post-graduate courses that we would like to initiate in Graz, access limits are indicated and meaningful. In this case those people really should be specially supported who want to go into a certain subject in depth, who have the qualifications, talent and interest. In order to do research with these people, I think access limits are indicated here. But, in general studies it would be unfair to impose access limits on one's own discipline – the big courses also have their advantages.

While a lottery or a first-come-first-served principle are certainly inappropriate instruments to control the number of students, systems like this are still implemented today in some universities. Szyszkowitz uses an interesting system based on maximising the compliance with the students' own preferences.

11.211 Szyszkowitz In earlier days at university there has been a lottery system for assigning the students to different diploma theses. Nowadays we use a computer programme where everybody can express three preferences and the assignments are optimised automatically in order to follow a maximum of the preferences. There are not any more access limits at the beginning of the study programme. I am in favour of free access to the study programme.

Internationality and student exchange

Student exchange is one of the rare instances where all the interviewees unanimously expressed the same opinion. They are all in favour of it, so student exchange probably plays an important role for good design education.

12.100 Question 66 *How valuable is it in your opinion to participate in a students' exchange or study abroad?*

12.101 Gruber Student's exchange is very fruitful. It is positive that we currently have around 15% of foreign students.

12.102 Kipcak Student exchange is extraordinarily valuable.

12.109 Heufler It is fairly new and has just started here. In any case it is positive. It is an enrichment, also a certain multicultural atmosphere develops, whereby we would like the number of foreign students to be higher and we are working in that direction. I certainly approve of the student exchange.

Hirschberg made the observation that exchange students are generally more active than local students while he can not yet explain why.

12.107 Hirschberg I think student exchange and internationality are very valuable. Funnily enough the exchange students are often the most active in my lectures. I am not sure what that says about the students here in Graz or my teaching methods. But international exchange as well as exchange between the students themselves is very valuable.

Zimmerman gives a reason for why student exchange is valuable.

how valuable is student exchange / study abroad?

☒ 10 very valuable

Figure 32: Internationality and student exchange

12.110 Zimmerman Oh definitely, certainly in design because you're getting a more global perspective. It really helps you as a designer. We're always stressing to, not just our designers but all the HCI students that you are not the user and there's nothing like an international experience that teaches you how different you are and your underlying values are from a lot of other people in the world.

Szyszkowitz points out that mastering the language of the country where a student is going to is a precondition for a successful study time abroad.

12.111 Szyszkowitz It is very valuable of course. I recommend to study a minimum of one year abroad in another country. A precondition is to learn the language. It does not make sense if you don't know the language. It only makes sense if you understand the meaning behind the things.

While for Szyszkowitz the preferred student exchange time is one year, Ehn also is content with half a year's time. Some of the effects of meeting new people can also be achieved when attending conferences, workshops or doctoral consortia.

12.104 Ehn Yes, very important. On the undergraduate level we're working very hard to try and find the possibility for them to go away for half a year and we've now started doing some very interesting exchange with some places in Australia and Germany. On the PhD level I think it's fundamental that you go away for half a year or a year. We're still a quite new place but we're building up contracts and networks for this. I find it very important for the students to have this experience. Also for masters and PhD students to have the chance to come out and have different experiences such as competitions or PhD consortiums at conferences that do not require a very high level of experience. The contacts you make there are fundamental for your coming career. – We have a format where half of the PhD work is courses and projects and half of it is thesis. The courses could be individual courses. The supervisor together with the PhD student develop an action plan yearly to deal with this. In the community as it works today there are a lot of international PhD schools. They are very useful. Many of our students participate in doctoral consortia which are very useful, typically held in conjunction with a conference like HCI International. We have organised ourselves a number of these too. But often the critical mass is too little at one institute.

Gründler and Domenig also emphasise the importance of teachers' mobility, while Raby reports about some problems she faced in trying to do this.

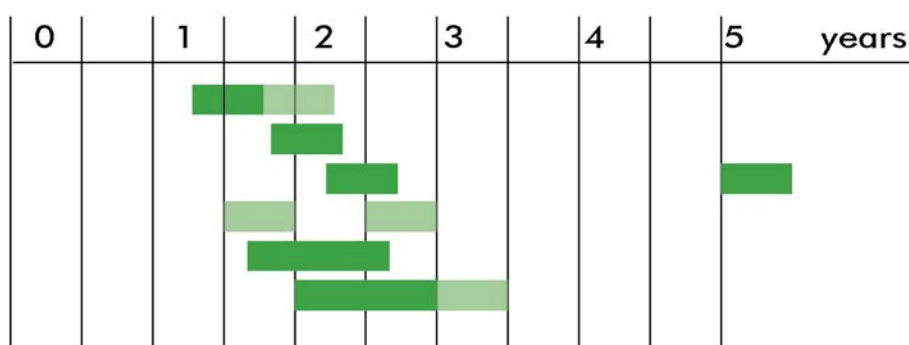


Figure 33: Optimum start time and duration for studying abroad

12.108 *Gründler* It is very valuable for students and teachers to participate in mobility programs.

12.106 *Domenig* I repeatedly tried to send talented people whom I appreciated to another university for an exchange. They always received appointments as guest lecturers abroad, some in the USA. In the mean time several of them are high quality professors abroad in several schools, for example private schools like the Cooper Union in New York. However the number is limited by several factors.

12.105 *Raby* I would have liked to work away. But this is a particular problem at the RCA, how to make research. I teach in an MA level and I was doing research separately. The two are very separate. I found that slightly problematic, and it never became resolved. That is a purely political thing in the Royal College, and it would be lovely. That's why I have never taken PhDs - in fact Kostas has been my first PhD student and then I left. Kostas Grivas has done a lovely project which he presented at DC Tales 2003 conference. He is one of our success stories, he won one of our prizes.

How valuable is student exchange?

<input checked="" type="checkbox"/> Very fruitful. Currently around 15% abroad.	Gru
<input checked="" type="checkbox"/> Extraordinarily valuable.	Kip
<input checked="" type="checkbox"/> Very important for all levels. Two times half a year. Also conferences, workshops, doctoral consortia.	Ehn
<input checked="" type="checkbox"/> Very valuable. Integrate courses and research activities, teachers' exchange.	Raby
<input checked="" type="checkbox"/> Very valuable, also teachers' exchange.	Dom
<input checked="" type="checkbox"/> Very valuable. Exchange students are most active ones.	Hir
<input checked="" type="checkbox"/> Very valuable for both students and teachers.	Grü
<input checked="" type="checkbox"/> Positive, enrichment. Multicultural atmosphere. We promote it.	Heu
<input checked="" type="checkbox"/> Definitely in design. More global perspective. We promote it. See how different people and values are.	Zim
<input checked="" type="checkbox"/> Very valuable. One year minimum. Also learn language.	Szy

Table 35: Internationality and student exchange

12.200 Question 67 *What is the minimum or optimum duration for studying abroad? Please explain.*

The recommendations given to this question range from half a year to more than one year. The interviewees agree that every exchange time less than half a year would be not enough. There can be individual differences. The optimum moment for student exchange is after the first one-and-a-half or two years of study.

Ehn already mentioned above to appreciate half a year to a year of studying abroad. Gründler takes a very pragmatic position.

12.208 Gründler *I do not know. If you are rich you can do it as long as possible. If you are under economic pressure do it whenever it is possible.*

12.201 Gruber *This depends on the individual student. Some students need half a year, some need longer. I know many people who study abroad for one to two years. A few weeks or*

Optimum start time and duration for studying abroad:

Half a year minimum, during first half of the study time.	Gru
Half a year, in the middle of the study time.	Kip
After basic knowledge is present; and in post-graduate courses.	Hir
Whenever; according to financial situation.	Grü
In 4th or 6th semester after gaining fundamental knowledge; not in first three or last two semesters.	Heu
One semester at least, to very different place.	Zim
One year study, half a year work. Get some insights only on the job.	Szy

Table 36: Internationality and student exchange

months is definitely too short. The ideal moment is probably during the first half of the study.

12.202 Kipcak This is difficult to say. Half a year is certainly ok, it should not be much shorter or much longer than that. The optimum moment is sometimes in the middle of the time of study, between the first and second part where a natural rupture takes place.

12.207 Hirschberg When it would be most valuable – I would say it is valuable at any time. And perhaps when the basic knowledge is present, but I would not like to state an exact time. I would definitely find it interesting in post-graduate courses, to address a very international audience and to tempt them here.

Zimmerman points out that the target location should be as different as possible from where you live. In Europe this probably always applies as soon as a student leaves his or her home state, while in the USA it may be necessary to select the destination more carefully. As stated earlier by Heufler the main benefit is to learn about other cultures or experience other ways of living.

12.210 Zimmerman I don't know if there's an ideal but certainly for students, if they could get at least one semester and that's hopefully quite different from where they grew up and where they went to school, it would be excellent.

It can be fruitful to add some time working abroad in a design office, a habit which in fact is done frequently by students. Of course they can also work in proximity of their school, but combining it with a stay abroad will definitely enhance the positive effect.

12.211 Szyszkowitz The optimum is to study for one year abroad and then to work for half a year there. The optimum is a combination of study and work abroad. It is a problem if people have only studied architecture and have never been working in an office, they will have a completely wrong picture of our profession. One needs to know that the design task only takes 15% of the whole job. This insight can only be gained by doing the job.

For all these reasons half a year of internship is mandatory at the Austrian polytechnics (FH), as explained by Heufler. It is usual to do this internship at a location remote from the school.

12.209 Heufler At our college the exchange is preferred in the 4th semester for the following reason: In the fifth semester is the practical work where the students are usually always in another country. In this case a certain exchange already exists. It could also be considered in the 6th semester. We would not like the stay abroad to be in the first three semesters or in the last semester before the diploma. It would be most valuable when the students have gained a fundamental knowledge and have developed here, so that a consolidated mass goes out and the students can, by different accesses, get to know different interpretations of the teaching that will definitely enrich them. It should be steered for in the sense of pluralism.

Future trends and challenges

As Lawson (1997: 169) points out, „recently we have become less confident both about the future and about the power of technology to solve our problems.“

This attitude especially influences the thinking of designers as a high sensitivity for the present and a picture of the future are central elements of design thinking.

While it is not directly related to education the question related to future trends and challenges has been added to this study because it certainly has an important influence on the attitude of an educator and the priorities he or she will assign to the elements of education.

13.100 Question 68 What are the most important challenges in your discipline for the coming years or decades?

There are two important fields of change reported by the interviewees: one is the speed of technological change and the other one is related to changes in society and in the position of the architect or designer. Most often these observations come with quite some feeling of uncertainty.

13.101 Gruber The biggest challenge is that the architect's job description has disappeared during the last two or three decades. The core competencies have been taken over by engineering and construction companies. Our job has been taken away from us. The architect has lost his/her position as the expert for spatial, geometric and organisational issues. The architects have still not realised that the design and construction of houses has become secondary, but communication and media determine today's town planning and the individual's life.

13.106 Domenig I believe that in this world that became synthetic, we must not lose our own language, our personality and originality. We must try not to create anonymous architecture, machine-made architecture. I believe that in these times where computer systems tend to dominate, only strong expressiveness and quality of gestalt will be important elements of architecture. Another aspect which is also considered by theoretical researchers is what will happen next: We have the digital world and we face the phenomenon of international communication. So the traditional office loses its importance because it is replaced by the possibilities of the digital space. So as an ultimate

Future trends and challenges:








































Architects'  traditional job description disappeared. Today's challenge of communication and  media.	Gru 
Media design is  not technology-centred. Technology changes, design issues are  stable.	Kip 
Narrative and time-based skills in  addition to spatial, place and object based skills.  New products are interactive services, ubiquitous  computing. Design  across social, interaction or narrative, computing and material space.	Ehn 
 Integrate teaching and research. Integrate PhD students.  Cross-discipline unit (architecture, product and interaction design). See how  technology affects disciplines.	Raby 
Must  not lose personality, language, originality. No machine-made architecture. Be expressive. Maybe  traditional way of working made obsolete by  computers. End of architecture?	Dom 
 Consolidation of new discipline and its education. Big  differences in how to teach architectural informatics.  Ubiquitous computing, hybrid data and physical world. Architecture is at  crucial point: marginalised by  technology or new meaning?	Hir 
Pressure for  job-oriented training versus  broad education; organised study programs versus free choice.	Grü 
Education should include  future trends and stay relevant.	Heu 
 Interdisciplinarity in education: design, social science and computer science. Find right balance between speciality and interdisciplinarity. Dichotomy between explorative  science and design as  "making". Will design become  fundable as science?	Zim 
 Form will always be important. Design of  everyday things like food.  Ecology.	Szy 

Table 37: Future trends and challenges

consequence, this can theoretically make architecture obsolete. But what will we do then? Maybe we will design chips for computers.

On the other hand Kipcak proposes to focus on the core issues in design which remain stable over time.

13.102 Kipcak I do not see media design as a technology-centred discipline but basically as a design discipline. Therefore I do not see a specific challenge for the next years. There will be constant technological changes in our tools, but this has been the case for 25 years, and this has already started with the invention of book printing. But principal design issues are a relatively stable discipline.

Szyszkowitz also points out the stability of form as the core issue in design. He sees some change to come in the importance of ecology.

13.111 Szyszkowitz This is a very interesting question. I believe that form will always play an important role, because people will always like beautiful things. Good design starts with everyday things like food. - Besides this, another aspect will emerge and become important in our profession, it is the ecologic aspect. Ecology will be reflected by public consciousness and have an influence on aesthetics and reception of design. This is necessary. There is still a lot of detail work to be done which we have not even started to explore.

Similar to what van Kranenburg has mentioned earlier, Gründler makes a point for the study time as a time for experimentation unlimited by any constraints, while in contrast to this his goal is to combine this with a necessary job-orientation.

13.108 Gründler Currently there is a big pressure to offer job-oriented training and education. I believe that education should not be so one-dimensional. Our challenge will be to combine these two goals, job-orientation and a broad basic education. Also there is a trend to strictly organised programs. At the university of arts we try to act against this by offering a small kernel programme and lots of free choice in a major.

Heufler describes the challenge of keeping a high quality standard in education.

13.109 Heufler The biggest challenge is definitely that our training will not only be at the current level of offices or studios, but where possible a step ahead. This means one should note and understand the future trends in design, which definitely has its limits. The relevance of the education and training is the biggest challenge.

Ehn explains the challenge of integrating the skills required for the design of future multimedial products and services.

13.104 Ehn In different design fields, be it architecture, be it interaction design or HCI, be it product design, - this conference is called „ubiquitous computing“ – the real interesting challenge today is the following: What we are working with now in the field requires design skills that are both narrative and time-based on the one hand and spatial, place and object-based at the same time. So when we are listening to them – actually, at this conference, architecture has become a question of space transforming over time. There are ideas of networks of places over time. Product design is no longer products but interactive services, artefacts. Interaction design or HCI is not just computations on a screen, a keyboard and a mouse but also narratives. Computation power makes it possible to create these narratives. And at the same time this has to be experienced, they have to be embedded in all kinds of materials e.g. steel, glass, ceramics, paper, new materials, whatever. The challenge for the coming years is to meet across these disciplines in this narrative-architecture space and also to find a role for the traditional engineer and computer scientist to contribute to this, trying to understand this. For the others there is a need to understand that computational power means support for this narrative time-based structure. And for the HCI and computer science people there is a need to understand that this computation is always embedded, not only in the social context but very much also in the material context. The competence to design across this material-social-computational-narrative space, that is the challenge.

Among the challenges specifically related to design education there is the shift to a PhD in design and to the notion of research to be introduced to design.

13.105 Raby One of the challenges will be to somehow run the teaching platform but equally do research and do PhDs plugging into that studio. The PhD students get very isolated, they get separate, but they need to be embodied, they need guidance just as well as the MA students. It would be lovely to have this approach where the studio and the research could work together in a better way, that would be phantastic, definitely. Personally I would like to teach cross-discipline unit between architecture, product design and interaction design, and other, because as I said earlier, what we would find in interaction design, particularly in the research studio, we would have the waves from fashion or technology, some would misunderstand but come and find us, some say „You should go to see Tony Dunne“, so we would end up with this kind of mixture of lost people.

We would love to have a kind of unit that went across the college and looked particularly at students who are interested in how technology affects their discipline, and think of ways in which they can start to embody it in their work and think about those issues. So that would be very much my idea which I would love to do, rather than just the architecture thing.

Hirschberg reports about the attempts to standardise architectural informatics and find a profile for this discipline. These issues are very similar to what happens in the design-related parts of the field of informatics.

13.107 Hirschberg There are many. From my point of view this discipline is growing strongly in all directions. In spite of this, one should try to attain a type of consolidation of the core elements. Also within the education, if that is even put into question anyhow. I think the training and the idea of what architecture is, is in a state of agitation and is developing more dynamically than ever. I think that this will continue in the future. When I talk about consolidation I say it with the background that at the moment I am part of an architectural informatics working committee, that is trying to clearly formulate the responsibilities of this department. Whereby in the German-speaking world, where 20 professors have come together there are already extremely big differences in opinions of how to conduct the course, how one understands the contents, how one views the research potential. I think this discipline will grow. One of the big challenges is this ubiquitous computing, that computers will shrink and will soon be everywhere, everything will be calculable, locatable, and the whole hybrid data and physical world that is approaching will keep us occupied. Then to find the right answers for this will be very exciting and interesting. I think that architecture as a whole is at a very crucial point, if it will let itself be eaten and marginalised by this technology; or if it, I hope, – swings upwards again with much more meaning, because all disciplines realise that it is not possible without more architecture, this question is still unanswered at the moment.

Zimmerman as well reports of the integration of disciplines and the profiling attempts of new ones.

13.110 Zimmerman One of the biggest challenges I see is: There's a lot of discussion in the HCI community about designers, social scientists and computer scientists working together. And while there's a lot of talk I don't think we have a good method and I don't think we've really achieved as much trust as we give lip-service to. We're training interdisciplinary students but almost none of the faculty are interdisciplinary. So I think it's kind of a frightening thing that we're doing but I'm also happy that we're doing it but we are not really sure what the result is going to be. And do we run the

risk of creating students without enough speciality that they can practise, or are we actually making people who can practise better because they actually have good empathy for the other groups they work with?

13.110 Zimmerman One thing comes to my mind, this is in an area that I'm struggling with right now: In the integration of computer science, behavioural science and design, I think there's a lot of pressure - and maybe it's coming from the computer science side, I'm not quite sure - for the designers to be behavioural scientists or to act more like behavioural scientists. And so I've been trying to figure out in my head what makes us different. So the very poor model I have right now is that behavioural scientists are very much interested in understanding rules, and so they generally test one variable at a time to develop a sense of rules, and this is considered knowledge and is fundable as science research. Designers are actually much more interested in „making“ things, so they have to apply hundreds of rules in the making of this thing, and it's often hard to say „This rule meant this much“, or „This variable counts for this much“. They can just say „This thing is better than this thing“, or „These are the rules I used to make this thing but I can't tell you specifically how much“. I think one of the challenges is getting scientific research to do the thing you are making. I think it's of huge value, but I think at least in the US the institutions that fund technology and science inquiry don't value that level of making, and I'm hoping that as HCI grows as a field that's trying to be more multi-disciplinary, other models of what scientific inquiry might be could become more accepted.

13.200 Question 69 *What can you do as a teacher in order to prepare your students to face these challenges?*

Kipcak refers to his last statement where he proposed to focus on the stable issues in design. This is very close to what Gruber proposes.

13.202 Kipcak See above, as far as technical skills are concerned in education.

13.201 Gruber We should not try to educate specialists, but generalists, because people will need to be flexible in the future and adaptive to changing requirements of the job market.

Both Gruber and Hirschberg also emphasise flexibility as a target skill for the education of designers.

How can teachers prepare students to meet challenges?

Educate ■ generalists, not specialists.
Need to be ■ flexible and adaptive.
Better not to have precise picture of job.

Gru ■

■ Dissociate teaching ■ design from teaching ■ technical skills.
Focus on ■ topics and metaphors instead of ■ practical applications.

Kip ■

Give architects competence for dynamic ■ new media environment.

Hir ■

Adapt to challenges of the moment, e.g. ■ new tools and skills.
Still educate ■ former skills,
e.g. manual drawing, manual mockup making.

Heu ■

Table 38: Future trends and challenges

13.207 Hirschberg I think that this depends a lot on the education or training; and in this sense I see it as a challenge for me as I am involved in the course, that one should equip the architects with competence and vision with reference to the new media, that they will be able to assert themselves in this dynamic environment and that the whole profession can remain in the picture.

13.300 Question 70 Can you name examples where this has been done successfully?

Gruber and Kipcak elaborate on their statements above and add an argument for the importance of flexibility in the field of design.

13.301 Gruber My experience is that the most open and less specialised people who are quick and flexible can adapt to new challenges. They generally are more successful than specialists who have a precise picture of their job, but may not find this in practice.

13.302 Kipcak I would rather dissociate teaching design from teaching technical skills. I would focus on topics, ideological and metaphorical space of topics. Our studies are too much overloaded and too much focused on practical applications.

Heufler brings an example on how the curriculum of his industrial design course had to adapt to the changes in technology that happened in the last decade.

13.309 Heufler A simple example: During the foundation of this course of study the conception of the curriculum was undertaken in 1993 and 1994. At that stage we thought that we could manage without computers in the first year of study. That was completely revised and we have changed it. The use of computers is now also in the first semester. Here we did not follow the trends of other colleges that have almost eliminated manual drawing and manual mockup making, but with us it is parallel and it has paid off.

Raby enlists several schools and names of educators who in her opinion represent ways to face the future challenges successfully.

13.305 Raby You should definitely talk to Gillian Crampton-Smith who is now in Italy, see what she set up there. She was looking at the process of that particular course. Now she went away and set up a new place on all the things she has learned. It must be really interesting to see what she thinks about how you educate in interaction design. So you should definitely interview her and see what she made there. Phil Thibault would be interesting, he is an amazing teacher. He presented at Doors (of Perception conference) last year (2002). He is Gillian's husband. Phil is an architect and he was in the Bartlett school of architecture for many years. He had the best students. I used to attend some of his crits, and he was so inspirational. He was Tony's PhD supervisor (Tony Dunne's). He commutes between London and Italy. He used to be an educator in one of the best schools in architecture. It comes from the same system. Most of the architecture schools run in the unit system way. In Bartlett they have something like twenty-five different studios. They have something which I hate actually: The tutors present their students' portfolios for the exam. Not the students can stand for themselves and speak up, but there tutors do, so I would have to go and justify. But my interpretation of my students' projects is radically different from their interpretation. What do they know, what is their understanding, not what is your understanding. I find that contradictory. It would be interesting to see what he thinks about that. I do not know, where does it come from? Maybe from the AA (Architectural Association). Did you talk to somebody from the AA yet? So maybe talk to Nigel, my professor, Nigel Coates, because he was educated and spent many years in the AA. Now he is professor in architecture at the Royal College. So he has had the experience to see the architecturally very rich space. And now he is in an art college. But he is obviously a very

different kind of architect. It would be interesting as well. Nigel lives in Italy, he is likely to be away as well.

Related reflections on the challenges of the future

In the interviewee's statements we have seen that there is different reasoning about the way modern technology did affect and will affect the design process. It is unclear whether and to which extent it will make traditional tools obsolete and the mastering of modern tools necessary to the designer. This uncertainty has an important impact on design educators who often do not know in what direction they should adapt their curricula. Design educators are in a similar situation today as shareholders who do not know whether and when they should invest their money into high technology values. Both a too conservative and a too progressive attitude can possibly result in a disadvantage with respect to their competitors.

The designer has a prescriptive rather than descriptive job. Unlike scientists who describe how the world is, designers suggest how it might be. Designers are therefore all 'futurologists' to some extent. (Lawson 1997: 113)

It has often been suggested that design is as much a matter of finding problems as it is of solving them.

„Of course the designer can turn out to be wrong about the future, like the high-rise housing built after World War II shows clearly. Today we wonder how designers could have been so stupid.“ (Lawson 1997: 113)

„Also we face the problem that today's society is changing rapidly. So how can designers respond to an uncertain future? Unlike the scientist, the designer cannot apply for another research grant, and write an elegant paper describing the complexity of the situation. Designers are expected to act. There are three main ways of dealing with this in the design process:“ (Lawson 1997: 115)

- 1) Procrastination: The first approach, procrastination, is based on the idea that somehow the future may become more certain if only we wait a little. However, this approach is flawed because once a problem has been identified it is no longer possible to avoid the consequences of making a decision. (Lawson 1997: 115)

- 2) Non-committal design: The second design response to uncertainty is to be as non-committal as possible whilst still actually proceeding. Thus architects have tended to design bland, anonymous and neutral buildings which are non-specific either in terms of their functions or locations. (Lawson 1997: 116)
- 3) Throw-away design: The third response to uncertainty is to design for the present only. This consumerist approach leads to short-lived goods and a waste of resources. (Lawson 1997: 117)

It turns out that many of our contemporary design problems are themselves substantially the results of previous design activity.

The design process rarely has a natural conclusion of its own, but must more often be completed in a defined period of time. The available time has an important influence on the design problems identified. (Lawson 1997: 119)

Related reflections on the value of sketching and drawing

Gedenryd (1998: 147) postulates that cognition is not an intramental process. Cognition does not happen within a mind working in isolation, but it happens through a concerted work of mind, action, and world. Interactive cognition has a superior performance than intramental cognition. For example sketches (as a part of the world) and sketching (as activity) serve a cognitive purpose.

To support his argument, Gedenryd states that sketches are not the products of the design process, but a means for inquiry. Like the act of sketching they serve a purely inquiring purpose. As sketches are produced in such an early stage of work that everything is still likely to change, „they can't be anything but inquiring materials.“ (Gedenryd 1998: 150)

Right from the earliest stages of tackling a problem, designers' thinking is mediated by the sketches or visible notes that they make to familiarise themselves with the material they are manipulating. Rather like language, these drafts have different levels of precision and formality (inflexions) depending on whether designers are using them for feedback to themselves, or for communicating ideas to colleagues and clients. The small size of thumbnails corresponds to their low level of detail. (Black 1990: 284; Gedenryd 1998: 149)

„Thumbnails are idea sketches; they are visual evidence of the thinking, searching, sorting process that brings out solutions. (...) Thumbnails are usually small because they are meant to be fast and undetailed. (...) Fill a sheet of paper (...) with ideas. Never reject an idea; just sketch it in and go on.“ (Arntson 1993: 5; Gedenryd 1998: 151)

Similarly, Lawson (1997) states that a designer never should make a drawing bigger than necessary.

According to Heufler the initial sketches in the design process serve the purpose of „making the designer free of the problem.“ To solve a problem means to free yourself from the problem first by sketching all initial ideas. After that the designer's mind will be free for new ideas.

If thumbnails are exploratory sketches, roughs are experimental ones. „The purpose is to test whether the idea still works on a larger scale.“ (Arntson 1993: 6; Gedenryd 1998: 152)

„For some strange reason, design in the everyday sense seems to be as remote from function, usefulness and other practical concerns as it could ever be. (...) Computer science often separates usability from functionality, but I find this distinction largely redundant.“ (Gedenryd 1998: 155)

„The designer re-creates the future situation of use. (...) Design can be described as an inquiry into this future situation of use. To this end, designers use a range of design techniques.“ (Gedenryd 1998: 157)

Traditional and modern tools used by designers to perform inquiry during the design process include sketches, paper prototypes (low fidelity and high fidelity prototypes), software prototypes (horizontal and vertical), mockups, scenarios, storyboards, prototypical users or personas, character maps of imagined users, simulations, ‚mental simulations‘ and mental models, and user tests.

„So important has drawing become in the design process that most schools of design will go to considerable lengths to teach drawing methods and develop drawing skills in their students.“ (Lawson 1997: 241)

In the field of design, the importance of drawing for the design process was underestimated for a few decades because of the apparent superiority of technical tools that were believed to replace it.

However, only a design drawing „represents a sort of hypothesis or ‚what if‘ tool.“ (Lawson 1997: 242) An architect can explore alternative plans by drawing. A product designer may repeatedly redraw an object gradually refining the shape and proportion.

Donald Schön (1983) has described the sketching process as „having a conversation with his drawing“.

For a good drawing „it is usually helpful if it does not show or suggest answers to questions which are not being asked at the time. Second, it seems helpful if the drawing suggests only a level of precision which corresponds to the level of certainty in the designer's mind at the time.“ (Lawson 1997: 242)

„In fact, so central does (drawing) seem to become for many designers that they become almost unable to think without a pencil in their hand.“ (Lawson 1997: 243)

Lawson reports of the Dutch architect Herman Hertzberger saying that when drawing, „a very crucial question is whether the pencil works after the brain or before.“ (Lawson 1997: 245)

While in our society drawing today is usually left to professional artists and designers or to a small percentage of amateur artists, Donald Norman reports of Chinese tourists who are used to draw in sketchbooks during sightseeing activities instead of taking photographs. This will lead to a much better understanding and remembrance of the visual impression they had.

Like the Chinese tourists designers often make referential drawings. „Designers do not just draw their own designs, but also record other designs and the world around them through drawings. (...) The process of drawing is one of the best ways we know to absorb design ideas.“ (Lawson 1997: 246)

Also in design the attempts to eliminate drawing from the design process turned out to be an error. Domenig believes that the dominance of the computer will maybe even become worse for another five years but then hopefully the trend will reverse. Design theorists believe that among designers it will be an accepted truth again that „drawing by hand remains undisturbed as the central activity in the process of design.“ (Porter 1988)

Aspects of reception, economy and gender

This chapter combines the issues addressed in the last questions of the interview guideline. I considered them as optional questions to be done in case the interviewee still has time to answer. The questions cover the issues of public reception of design work, conflicts between aesthetic, usability, and economic issues, as well as gender-specific issues in design.

14.100 Question 71 In your work, do you take into account the reception in the public of contemporary art, design, architecture or technology?

In this issue Domenig takes a special position as he is the only one of the interviewees who declares not being interested in the public opinion. While he does care about the users of his buildings, what he wants to point out is that he does not care about the critiques.

14.106 Domenig The reception of my work in public does not interest me. I don't do architecture in order to become internationally well-known. Many architects do this and try to use publications to get known. The only thing in which I am interested is whether my architecture makes sense. Whether the world will be interested in my work will depend on the quality of the project. If I create something original I will get international attention. The professional world from Canada to Japan knows my „Stone House“.

For a different reason Zimmerman does not value the public opinion for his work: In interaction design the functionality and usability are central and the identity of the designer is not.

14.110 Zimmerman I think it's minorly important what the public knows, I don't think it's huge. Well it has two sides to it. I think a lot of good design is design that people don't see, and that's what it's designed for: to not be seen, or to not be noticed. It's only when something doesn't work that the public recognises a lot of really poor design. But I think, different from architects where there are certainly examples like Philippe Starck who've built a career around making up objects, I think in interaction design it's less driven because it's much more collaborative, so it's much harder to isolate a single vision. I think film making, architecture or product design actually have a lot more of that singular vision. Interaction design isn't like that, so the public recognition might be „Oh what a great product“ but not „Oh, this is a Konrad Baumann product.“ I don't think it's a brand or is ever going to be a brand.

**Do you take into account public reception of design?
Does it influence your lectures or your own work?**

<input checked="" type="checkbox"/>	Yes. Lecture "art and the public". Exhibitions for students.	Gru
<input checked="" type="checkbox"/>	Yes. Has influence on lectures and own work.	Kip
<input checked="" type="checkbox"/>	Yes. Organisation of events, congresses, publications. Faculty of architecture should do more public relations work. No influence on work.	Hir
<input checked="" type="checkbox"/>	Yes. Mass media often use buzzwords and highlight trivialities. No influence on lectures. Schools need funding, so they do public relations.	Grü
<input checked="" type="checkbox"/>	Yes, we register dialogue between disciplines and public. Not in a structured way, however. Discussions with students. Influence from specialists and target group; no pressure against progressive work.	Heu
<input checked="" type="checkbox"/>	Yes, important issue for architecture, not so much for art. Relevant for lectures.	Szy
<input type="checkbox"/>	Minorly important what public knows. Lot of good interaction design is not made to be noticed. Other design disciplines are different.	Zim
<input checked="" type="checkbox"/>	No, does not interest me. Only design quality matters. / No influence on work, but lack of feedback from end users is a pity. / Problem: limited understanding for architecture from people at authorities.	Dom

Table 39: Public reception of design

The other six interviewees who answered this question declared that the public opinion about their work is relevant for them.

14.101 Gruber Yes we are very interested in this.

14.102 Kipcak Yes I do.

While he considers the reception of his work by mass media as interesting for him Gründler criticises their selection of what is relevant news.

14.108 Gründler Yes I am interested in the public reception of science, art and architecture. Sometimes trivialities are highlighted, even outdated ones. Mass media have a strong pressure to use buzzwords. But lots of information cannot be communicated using buzzwords.

From the fact that design products should be relevant and useful for the public Szyszkowitz concludes that a designer in turn should take the public opinion into account.

14.111 Szyszkowitz Yes of course I do. The public and the building in public space are very important issues in architecture. The public is more relevant for architectural design than for other disciplines of art. I do not consider architecture as a kind of art, but it has a lot in common, especially because it requires sophisticated intellectual and sensory possibilities.

Heufler and Hirschberg believe that a school should have a structured way to deal with the media, maybe like a company that has a manager for public relations. More than this, Hirschberg also detects a need to improve the standing of architects within universities and the scientific field.

14.109 Heufler We definitely register the attention, this dialogue between art, architecture, design, technology and the affected persons. This analysis and discussion is very important. At the moment it is not implemented in a methodical and structured way, but we are sensitised to this dialogue.

14.107 Hirschberg Yes I am very interested in the reception of the public with regards to art, architecture, design and technology. We definitely try to orientate ourselves to the public with events that we hold here. The faculty of Architecture should be bringing out a newspaper that is directed at the public. I really think that architecture has a problem in conveying, also within the university as well as by the public it is not taken seriously as a scientific discipline; that architects are easily taken to be „nutcases”, that there is too little definition of what it is, and what architecture does and why it is important. And here the university has a very clear task.

14.200 Question 72 *If yes, does it influence your lecturing?*

Their opinion about public reception is believed to influence their lectures or seminars by five interviewees, while this is not the case in Gründler's opinion.

14.208 Gründler No I do not think it does.

14.202 Kipcak Yes it does.

14.211 Szyszkowitz Yes of course this is relevant for my seminars and lectures.

Concrete examples of how this influence takes place are named by Gruber, Heufler, and Hirschberg.

14.201 Gruber We have a lecture called „art and the public“ at least once a year. Also we organise exhibitions for our students.

14.209 Heufler It is included in that such topics always trigger discussions with the students and we also react to this.

14.207 Hirschberg Through the organisation of events, publications and congresses.

14.300 Question 73 *Does the public opinion influence your own design work?*

While Hirschberg declines, a similar positive opinion to the one expressed by Szyszkowitz (14.111) is stated by Kipcak.

14.307 Hirschberg No. Not in the sense that they could dictate.

14.302 Kipcak Yes it does. A designer works for the public, so we cannot ignore this, and it is always interesting to deal with it.

Gründler expresses a similar, but even more transparent and pragmatic reasoning.

14.308 Gründler The schools where I work depend on public funding and also increasingly on private funding. That is why we need to position ourselves in public and influence public opinion positively, because this will influence our funding.

Similarly Heufler estimates the necessity of dealing with the public opinion, with the restriction that it has to be backed up by competence and knowledge.

14.309 Heufler One should be cautious as to where the opinion is coming from when referring to the public opinion. If it comes from the specialist side, we take it very seriously. We are also aware, that with progressive work one can encounter great resistance from the general public. One has to withstand it. If one has to go into the concrete demands of a target group, then it should be taken very seriously. We still see ourselves as service providers.

As already mentioned earlier Domenig detects a lack of user feedback in architecture. On the other hand and in line with Heufler, he complains about the lack of competence among the representatives of public institutions.

14.306 Domenig I have always experienced a lack of feedback from the end users. When I do an architectural project, my only goal is to make the future users feel good. But I never experienced the users' reaction to my work. There was no institution that would have researched this user feedback. However, we can state that my Graz University building for the law, social and economy sciences (ReSoWi centre) works. I have won a nationwide competition, despite the fact that I proposed larger spaces than required, because the project included some reserve spaces and some rooms are higher than necessary for enhancing the quality of experience. Originally the project was planned for a certain number of students and employees. Because of the raising number of students, there are more than twice as many people studying and working there now. The building still works and supports this number. So maybe this answers your question.

15.106 Domenig (...) A certain barrier for good architecture is represented by the distance and the limited understanding of people who are responsible for new buildings at the government and at the authorities. They have a limited understanding and for example they stated that my wave-like forms will restrict the functionality of my university library. They say that one can do this as well in an ordinary, usual way. This is because they are not used to it. So my only reassuring feedback is that a building is in use for a few years and still works with the planned capacity.

Conflicts of interest between aesthetic, usability and economical factors

Both the two following questions on potential conflicts of interest show a high degree of similarity in the positions of the interviewees. While of course not everybody has the same opinion – this would be rather impossible to get in a qualitative research like this one - there is not the full range of answers from acceptance to rejection which we have seen so many times in this study.

A reason why this wide range of opinions does not appear in the following questions could be that these issues have already been subject of the discourses in design theory for several decades. So we could consider these issues as mature, which implies that our interviewees have been faced several aspects and positions toward these issues.

This would be a possibility to explain why these issues are seen in a differentiated way by the interviewees and do not show any extreme positions.

On the other hand this would be an indication that didactics of design is still a too young discipline and a lot of discussion will be needed to maybe narrow and synchronise some of the issues in the view of the design educators.

15.100 Question 74 Do you see a conflict between aesthetics and usability in design?

The conflict is rejected by Gruber, Gründler, and Hirschberg for similar reasons.

15.101 Gruber This conflict only happens with bad products that have either a lack of usability or a lack of aesthetic quality. Good design solves this conflict.

15.107 Hirschberg I would say that this must not be a conflict, otherwise there is something wrong anyway, but I do not want to go into this here.

15.108 Gründler I do not see any conflict here.

While Kipcak sees it as a central issue he rejects the notion of a conflict as well.

15.102 Kipcak This is a central issue in design. The pragmatic dimension and usability need to be incorporated into the aesthetic concept. It is not a conflict but a challenge and an issue.

Szyszkowitz and Heufler explain a central task of a designer which is to integrate multiple requirements into one solution.

15.111 Szyszkowitz There is a relationship and affinity between aesthetics and usability, but they do not exclude each other. If I try to exclude one or the other, there is something going wrong. Good design includes both of them. First, the design has to function. After that, the art is to enhance some aspects I want to focus on, while keeping the functionality in the design.

15.109 Heufler It is exactly the responsibility of a designer to bring these differing demands, that are often contrary, to a common denominator. That is exactly what makes it fun, this is also the challenge, to actually find this balance. I do not experience this as a painful conflict, more something that one has to succeed in, from a holistic view it is a necessary challenge. – *KB: One often says, designers work even better with strict criteria than when they have complete freedom.* – *Heufler: Yes that*

Conflict aesthetics - usability:

■ Only in case of bad products. Good design solves conflict.	Gru
■ Not a conflict but central issue and challenge to incorporate both. I avoid conflict, sometimes with aesthetic effect. Critical dialogue in courses.	Kip
■ Many have functional view; I consider complexity and unity of buildings and of design, which is not a sequence of separated steps. "Architecture as aesthetic organisation", i.e. design and functionality unified. No conflict. Design has to be usable but goes beyond. Flexibility e.g. by functional grid. Deduct reality from utopian dreams and visions.	Dom
■ Must not be a conflict, or it is evaded. Question is not productive. All user needs will never be met. Beauty alone is not an argument.	Hir
■ Do not see any conflict.	Grü
■ Meeting requirements is designer's task and necessary challenge. Constraints make it easier. You have to decide and compromise. Permanent topic in courses.	Heu
■ Good design includes both, no conflict. Function first, then enhance it.	Szy
■ Aesthetic, usability and economic aspects are always in conflict. Interesting challenge. (...)	Zim

Table 40: Conflicts of interest

is right. If one takes an example from architecture, to build on a free green plot is probably more difficult than building something between buildings, because left and right there are demands that one must meet.

Domenig explains with two case studies how he deals with conflicting requirements in practice and what his theory is that backs up this process. The case studies are one of his early buildings at the Munich Olympic games and one of his biggest buildings in the heart of the Graz University campus.

2.206 Domenig At the university I was responsible for „Gebäudelehre, Wohnbau und Entwerfen“ – building, housing and architectural design. This is dealing with the organisation of buildings, which I always considered in their complexity, in their spacial dimension and in their unity. My predecessory generally had a purely functional view on buildings. So I wanted to show the students that architecture is not only about doing analysis, creating functionality, doing construction engineering, selecting materials, and maybe doing some design at the end, but that it is

a complex but unified thing. I coined the term „architecture as aesthetic organisation“, which says everything: aesthetic is the design part, organisation is the functionality part.

15.106 Domenig For me there is no conflict. The form in architecture has to be designed to be usable. And the architect has to provide a certain quality of form. Design, however, goes beyond functionality. For example I designed the ReSoWi centre to have „waves“, a wave-like shaped facade, they are not required by functional constraints of course. But in the end the university restaurant works well. All parts of a building have to function. A certain barrier for good architecture is represented by the distance and the limited understanding of people who are responsible for new buildings at the government and at the authorities. They have a limited understanding and for example they stated that my wave-like forms will restrict the functionality of my university library. They say that one can do this as well in an ordinary, usual way. This is because they are not used to it. So my only reassuring feedback is that a building is in use for a few years and still works with the planned capacity. – There are also functional constraints like a minimum office room size for professors or for lecturers. We simply have to meet these requirements. There has to be a certain flexibility in architecture which we can meet for example by implementing a functional grid. This is the purely rational side of our work, this has nothing to do with the creation of form.

15.106 Domenig (Note: The following case study has been already mentioned earlier in this text.) Teaching at the university is done both by real tasks and utopian tasks. I can show you some early utopian projects that we made. In my opinion, utopia is very important for students. They need to work on dreams and visions and explore the limits of theoretical feasibility. It does not always have to be possible to build it. Utopian concepts offer an ideal principle from which I can try to deduct reality. For example a system of support beams has a certain shape and needs to be packable. So these are the things that define the whole architecture and the whole horizontal and vertical traffic within the building. The utopian ideas in your mind are at the basis of that. They set the targets for new dimensions in architecture. How could the form of an artefact be? For example I had an early and visionary idea for a project in Agadir, which defined the shape for a pavilion for the Munich Olympic games in 1972. The association to a utopian vision can give you a guideline on how to work under real conditions.

15.200 Question 75 *If yes, how do you meet this challenge in your own work?*

There are two in-depth questions which have been answered only by a few interviewees. However, a few interesting aspects have been added.

15.202 Kipcak I try to avoid this conflict. But sometimes the act of avoidance will have an aesthetic effect, so the problem will create a sparkle.

15.209 Heufler As I said I do not see it as a conflict as such, but as a challenge. This is art. Of course there will always be compromises. One must ask oneself, is aesthetics or ergonomics more important for a tool? One has to decide. But a tool with good ergonomics can be aesthetically pleasing. There are a lot of examples for this.

15.207 Hirschberg KB: *So you have Nielsen or Keith Andrews as guest lecturers, but not that you really see it as..., probably the designer would be hindered with this, when one implants this into them, this...; the conflict is avoided or evaded, I presume?* – Hirschberg: Exactly, the conflict is evaded. It is not productive to pick it out as a central theme. Because it is different to make a prototype, a proof of concept than it is to make a commercial application. In the end I think that it is not the aesthetic and the usability. It really has much more to do with usability. I think it is definitely not the case – that the projects done here are therefore not usable, because aesthetics is more important, because within the framework of the course we cannot manage to make something for the ”presumed most stupid” user. But that one says instead ”but it is really beautiful” I would reject these arguments from the beginning. In spite of this I do not think it is useful to reject every idea all because of usability.

15.300 Question 76 *If yes, does this influence your lecturing?*

While only two interviewees directly responded to this question we can conclude from what has been said earlier that this issue does indeed play an important role in design education.

15.302 Kipcak Yes, I mention this issue in the critical dialogue which is central in my teaching.

15.309 Heufler In the course it is naturally a permanent topic, this coping with such conflicts. If a student, for example, positions the windscreen of a car too flat – for reasons of form – that the driver cannot see out of it, then we would try to find a compromise between aesthetics and usability and it also works.

15.400 Question 77 *Do you see a conflict between design aspects and economic aspects in your work?*

Again like for the last question the interviewees show balanced and not too widespread positions in this issue. As seen before the designers indeed see it as their core competence to deal with conflicts like these.

15.401 Gruber This conflict is always there, but it should be seen as a challenge and not as a problem. This conflict happens everywhere, not just in arts, design and architecture.

15.402 Kipcak Good design does not need to be expensive. This issue is part of our professional work. The budget is central at the beginning, but it becomes relaxed when a set of strategies for solution have been developed.

Heufler emphasises the importance of a designer in industry to play the role of a creative outsider who is not blinded by the organisation or company-internal tradition and therefore can initiate changes of paradigm.

15.409 Heufler Here I must say that I also see this as a fundamental responsibility, that no conflict develops here. I would even say that this should be the aim, through good and intelligent design one can even save cost, for example, the use of certain parts several times or a simple construction, or, also as an outsider to point out the organisational blindness of a company.

As Domenig mentioned in an earlier chapter it is the advantage of the time of study that people can act without having to take into account economic constraints. However, he states that this does not justify every silly idea.

15.411 Szyszkowitz This is a very difficult issue because there is a big gap. You can have a sophisticated design, but it will not be feasible within the economic constraints you have. At the university, however, the students should have the possibility to do such utopian designs. But I always tell

Conflict aesthetics - economy:

Conflict is always there, everywhere. No problem but challenge. Similar to time pressure in course.	Gru
Good design is not necessarily expensive. Experience is necessary. Students are free from this pressure.	Kip
Fundamental responsibility to avoid conflict. Design for cost savings. Independent designer is free of company's constraints. In our course co-operation with engineering professor.	Heu
Aesthetic, usability and economic aspects are always in conflict. Interesting challenge. No engineering process to get there, individual methods. Usability often excludes sellability. No programme teaches whole product life cycle. No business faculty involved in HCI. Disciplines need to understand each other.	Zim
Difficult issue, big gap. Students can do utopian design. Outstanding design justifies high cost, but high cost does not make good design.	Szy

Table 41: Conflicts of interest

them at the same time: If your intention is to create something outstanding and utopian, it really needs to be outstanding. You cannot justify a design that is an economic nightmare by declaring that it is an outstanding utopia. The label of utopia does not make a thing outstanding. – We could build St. Stephen's cathedral (*in Vienna*) in smaller scale and for half the money, but would it still meet the requirements of the people – and of God? (*Laughs.*)

Zimmerman points out that solving these conflicts is a core competence of a designer. He detects a lack of contact between the fields of business and interaction design.

15.410 Zimmerman I think that design, usability and economic aspects, these three are always in conflict and that's what makes design interesting. You're trying to find solutions in a space that address the aesthetic, the usability and the price point. There is no magic way of doing it which is why design is less of an engineering, process driven, there's no process to get there, everybody has their own methods. But I think that's the real challenge. I think generally the usability community has focused so heavily on making things usable that they've forgotten what makes a product sellable, and until someone buys it, it really doesn't matter how usable it is. And they may think

they're designing for the first-time experience but the first-time experience is usually selecting it off a shelf which is earlier than they often imagine. I think in general no academic programme that I'm aware of teaches the whole product life cycle from all of the early conceiving, anthropology work to development, to support for a product, to brand recognition which exists throughout. And I think generally in the HCI world that the business component, the financial viability is a piece that's seriously missing. Basically if you go to any of the academic conferences no business faculty are participating.

15.500 Question 78 If yes, how do you meet this challenge in your own work?

Kipcak points out that there is mainly an intuitive approach necessary in order to solve design problems.

15.502 Kipcak I use my experience and routine.

Heufler explains why it can be better for a designer to be self-employed than being part of an organisation.

15.509 Heufler This is also the advantage of being self-employed, one is used to many experiences in different kinds of companies and jobs and one can use these experiences in new themes. We spoke about organisational blindness beforehand.

Zimmerman sees a problem in that designers do not make the financial benefit of their work enough transparent to their customers or employers.

15.510 Zimmerman That's definitely a challenge for the future because I think certainly interaction designers and UI people in general, UI developers need to understand the cost of what they're asking and the values, so that they can more clearly articulate the value they bring. I think you see it right now that just in the last three years (from mid of 2000 to mid of 2003) I'd say that more than half of the people I know in the usability field have been laid off because their companies can't see the value that they add to the product. They abstractly realise it but in tough times if I can't put a number to it it's gone. And that's (why I say) we're suffering from our own fault.

In this issue I proposed and implemented a way of making usability improvements visible as a cost saving factor via the positive effect on call center activity of a company (Baumann (1999, 2000).

15.600 Question 79 If yes, does this influence your lecturing?

Kipcak makes the point mentioned already earlier by Domenig and Szyszkowitz saying that economic requirements can be pushed aside in student projects.

15.602 Kipcak I point out that in the seminar the real-life conditions like time and money do not apply. It is not central to be economically correct as a design student.

On the other hand Gruber even tries to simulate the economic requirements of real projects at the university.

15.601 Gruber Economic pressure is represented by time pressure for the students. We even try to simulate this conflict at the university. For example we have sponsors who pay for the implementation of projects, and if a project is too expensive we cannot finance it.

Heufler simulates the multiple conflicting requirements at his school through project supervision by a multidisciplinary team of educators.

15.609 Heufler It is expressed as far as the supervision of a project is not undertaken by the designer alone, but generally – this refers to all project work – together with an engineering expert. At our college an employed engineering professor also supervises the projects and here of course the emphasis is on the economic aspect: With which production technology can I implement the whole (project) in an economic way? This has really paid off and in practice it is well rewarded.

15.700 Question 80 Do regional aspects play a role in your own work?

Kipcak and Gruber declare that for them regional aspects are not really relevant.

15.702 Kipcak Not often, only in some projects.

15.701 Gruber We try to teach at an international level, in terms of quality as well as provide a location-independent horizon. That is why we do not favour regional aspects.

On the other hand the four remaining interviewees who answered this question said that for them regional aspects do play a role indeed.

15.711 Szyszkowitz Yes of course they do. I am not in favour of an extreme adaptation of regional design to international standards. First we have different human requirements and there are regional aspects. I cannot create the same design for Sydney and for Stockholm, because people are different there.

After Szyszkowitz' comment who represents the view of an architect, Zimmerman presents the view of an interaction designer. The different standpoint is clear from the fact that a building will always remain on the same location while an electronic product or even more so a website is not necessarily related to a geographic location.

15.710 Zimmerman I think that there's definitely a sense that you need to design locally for a variety of reasons and that international development needs to have designers from multiple areas working together. So really the only advantage of working in the US for me is, for designing things in the US is I understand at an implicit level a lot of the business models of how things are done in the US and a lot of the trends and fashion of the US. And that's experience you can only really get by being there.

Heufler talks of the implication for an educator because schools in many cases have a limited region from where students stem and where students will go to work later.

15.709 Heufler I would say that regional standpoints are decisive in as far as: a little example, In Styria there is the (car) automotive cluster. That is why in our industrial design course one of the four projects is solely dedicated to transportation design, whereby this also follows a trend throughout Europe, because the topic of (car) automobile design also plays an important role in Europe.

Finally Gründler sees the issue of regionality as from the perspective of a performing artist in electronic music.

15.708 Gründler I consider regional aspects, because the more we are connected and networked worldwide, the more important regional aspects will be. We should not become narrow-minded, but an artist should create sounds or designs specific for his/her region of origin. It is interesting to see what is special in a certain place.

Importance or relevance of regional aspects		
<input checked="" type="checkbox"/>	Interesting to see location-specific design in connected world.	Grü
<input checked="" type="checkbox"/>	Designer in place better understands trends, fashion, business models.	Zim
<input checked="" type="checkbox"/>	No international style. Design needs to be location-specific.	Szy
<input checked="" type="checkbox"/>	Regional industry reflected in course and co-operations.	Heu
<input checked="" type="checkbox"/>	Not often. International exchange more important than regional aspect.	Kip
<input checked="" type="checkbox"/>	Teaching at international level, no regional aspects matter.	Gru

Table 42: Importance or relevance of regional aspects

15.800 *Question 81* *If yes, does this influence your lecturing?*

Both Gruber and Kipcak again underline their international position.

15.801 *Gruber* We try to be international.

15.802 *Kipcak* No, because international exchange is more important than regional aspects.

With a somehow different interpretation of the question Heufler points out again that for a school the cooperation with a local network of industry is of high relevance.

15.809 *Heufler* Yes it is implemented like that here. There is also a co-operation in the area of research and development with regional businesses and international companies.

Gender-specific aspects of education

The last question in the interview guideline was about gender aspects of design. While this is not an education-specific issue I wanted to include this because it is an issue of general interest and certainly should be taken into account by every educator as well.

In their answers to this question the interviewees are mostly saying that there is no gender difference in design. However, this is not representative as most interviewees are of male gender. I did not have a specific target on what the gender ratio of the interviewees should be. It just happened to be heavily dominated by male design educators which probably reflects quite well the gender distribution in our design schools.

16.100 Question 82 Are there gender-specific differences concerning the talent in design?

Heufler enlisted some gender-specific properties known and researched by psychology. He tries to explain why there may be an influence caused by differences in education during childhood.

16.109 Heufler Within the framework of our course we have hardly come across this. In the admission area (entrance examinations, ed.); for example, in spatial imagination, especially in representative geometry we find more weakness in women than in men, whereby our tests are implemented by a woman, therefore the results are definitely not somehow biased. What could be caused by certain stereotype behaviour, at least it was like this earlier, is that men, for example, make more things, did a lot of handicraft in their childhood, they deal more with three-dimensional elements than women. This could change in the future, where young people are increasingly influenced by Gameboy etc. and therefore grow up in a two-dimensional world.

All the other interviewees who answered this question stated not to see any gender differences in the field of design.

16.101 Gruber No there are no gender-specific differences.

16.102 Kipcak No I do not see any difference concerning the design disciplines.

Very similar arguments are presented by Domenig and Szyszkowitz who have observed a certain time-dependent oscillation in architectural design quality with respect to gender.

Gender-specific aspects: equal skills and opportunities

<input checked="" type="checkbox"/>	No differences in design disciplines.	Gru, Kip, Dom
<input checked="" type="checkbox"/>	Earn same money in my company and others I know.	Kip
<input checked="" type="checkbox"/>	Not any more. Sometimes men, sometimes women are stronger in architecture.	Dom, Szy
<input checked="" type="checkbox"/>	No difference at department. Problem in technology and industry. No particular disadvantage in practise.	Zim
<input checked="" type="checkbox"/>	No differences in education and work. Same payment in my office. There are sensitive men and powerful women. Women get even better grades.	Szy
<input checked="" type="checkbox"/>	Equal opportunities in arts, design. Why do men dominate technology?	Gru
<input checked="" type="checkbox"/>	Different results in entrance tests (done by woman), e.g. in spatial imagination. Handicraft helps to train this, computer games train different skills. More men in course, technical focus. Equal success in work.	Heu
<input checked="" type="checkbox"/>	Women are under-represented in technical disciplines. No equal opportunities.	Grü

Table 43: Gender-specific aspects

16.106 *Domenig* I have no prejudice whether somebody is a man or a woman. Gender is not important for me, only the quality of work. There are times where the boys are stronger in architecture, and there are times where the best work is done by women. I have experienced this during a few years at university.

16.111 *Szyszkowitz* This question is often asked. It needs to be considered carefully. I do not believe there are gender-specific differences. I know many boys who work in a more sensitive or empathic way than the women. I also know women who have so much power and such a martial attitude that the men will appear as softies compared to them. So I do not see gender-specific properties. For the moment women are better in this profession. There are more women studying architecture. I have 55% to 60% female students. A lot of them are very talented. They have an easier attitude toward form.

16.200 Question 83 Are there equal opportunities for equally skilled and talented men and women in your discipline?

Four of the interviewees expressed some doubt in their answers, namely Gründler, Gruber, Szyszkowitz, and Zimmerman. They all related their criticism to the technical disciplines.

16.108 Gründler I try to keep it evident that there women are under-represented in technical disciplines. The opportunities for men and women are not equal. You only need to count female professors.

Similar to Gründler also Gruber describes the known unbalanced gender distribution in the fields of technology, which is not seen in the design field.

16.201 Gruber In arts and architecture I believe there are equal opportunities for men and women. Informatics and technology are dominated by men, but I do not know why, maybe for historic reasons.

Szyszkowitz implicitly criticises today's mainstream for not yet being gender-neutral.

16.211 Szyszkowitz Absolutely. I believe that there is no difference in our profession. We have more women than men in our office. I treat them all the same and they all get the same payment. So we are ahead of the mainstream.

16.210 Zimmerman No, I don't but I think that might be particularly where I am. So I'm working in a computer science department but it's a computer science department that for many years has fought strongly to have women faculty and women students. So I think it is a micro-culture. I don't think design struggled to get women involved because they've had them. And I think that behavioural science – at least in my experience - has traditionally had a number of women in it. So it's computer science that's been the problem. But just where I happen to be right now has less of this problem. Certainly during my time at Philips it was like "Do women work for Philips?" It was quite shocking, but I don't think in practise the women are particularly disadvantaged.

Domenig describes this as a historic phenomenon which is overcome today.

16.106 Domenig In earlier days, immediately after World War II, there was sometimes a hostile attitude toward women and also toward people from other countries. This is not the case any more.

Kipcak and Heufler as well do not see any gender difference today.

16.202 Kipcak In my company boys and girls make the same money. This is the case for all design companies I know.

16.209 Heufler Here we do not have the slightest problem, although I must say, due to our technical focus the proportion of women to men is 1/3 to 2/3 respectively. In career success there is no apparent difference. If someone is committed, motivated and competent, then it makes no difference.

16.300 Question 84 *Is this reflected in your lectures or seminars?*

With respect to their lectures or seminars it was quite foreseeable that all interviewees gave a politically correct answer.

16.301 Gruber No, gender has no influence for us.

16.302 Kipcak No.

16.309 Heufler There is equal treatment – and with that equality.

16.311 Szyszkowitz Yes this is reflected in my teaching. All are treated the same. Women get a 1.0 grade at least as often as men do.

17.100 Question 85 *Could you give me some examples of your seminar exercise briefings or of your students' work?*

At the end of the interview I asked the interviewees whether they could give me material and received books by Domenig and Szyszkowitz as well as lots of advice on what to do further in my research. Some of these are already mentioned earlier in this text, others have not been part of the tape recording any more.

17.104 Ehn Yes, send me e-mail and I will send you some examples and my CV. – KB:
Could you give me any recommendations of people whom it would be interesting to interview? – Ehn:
Wendy Mackay would be good, and a colleague I have at home, Jonas Livgrin, but he would tell

you a similar story than I did. He has some very strong points especially on the pedagogic side.

17.111 Szyszkowitz We do summer workshops every year. The results are presented in a booklet. We deal with different cities, like Stuttgart, Krakow, Kapfenberg. We stay in the city for two weeks. We get a briefing by the city authorities. And later, I will hire the best students for my office.

Summary

One of the expectations we had at the beginning of this research was to find one or a few distinct didactical approaches that are familiar in design education. As stated earlier, it was our aim to make use of this approach or these approaches in HCI education. It follows that we were looking especially at differences between the didactics of design and other disciplines. It was a question whether it would be possible to re-use or apply a classical didactical approach or whether a new design-specific one exists. Also the first few interviews had the side-effect of being a test for the interview guideline, i.e. it was interesting to see whether the interviewees would feel that the questions were appropriate and the issues raised were interesting for them as well.

Surprisingly enough it turned out that in most cases the interviewees faced exactly the same open questions we did and so I received extensive answers. Sometimes even full case studies were presented during the interviews. While it was originally planned to carry out only a few interviews until most of the current practice or state-of-the-art has been collected, it turned out that even after ten people had contributed to this research there was still new insight to be gained with every new interview. Only in some cases there was a common understanding on a topic, while in most of the questions the answers differ considerably and all of the different positions seem to be quite equally reasonable and well-founded either on literature or on extensive personal experience of the interviewees. Thus, the first interesting result of this study was the extreme diversity of design education methods.

In general it can be said that not one single statement or recommendation can be given on the general question of this thesis, namely *„how designers teach“*. There are not even a small or larger number of didactical approaches that can be distinguished. Instead, there is a wide range or a pool of methods used in design education. From this pool, every design teacher picks his or her favourite methods, usually modifies them, combines them in a useful way or invents new ones. Therefore the methods have a certain overlap and some of the elements of methods can be found several times in different context. For example the methods of workshops and problem-based learning are quite close to each other; or hearings and critique sessions („final crits“) have many aspects in common.

Also in this study there could not be detected any important influence of „trends“ or „schools“ in design education. While there are definitely trends in design, the design educator seems to be more

of an individualist. This also corresponds well to the fact that the personality of the design educator seems to play a very prominent role in teaching design. This goes so far that design seems to require a 100% involvement of the tutor's „body and soul“, to the extent that the tutor presents „himself as a design method“ (see interview Orhan Kipcak). While it is typical for a researcher or educator to be very convinced of his or her findings and believes, it seems to be characteristic for the design discipline to have a very high degree of involvement of the teacher's personality in the tutoring.

The following settings are widely used in design education:

One-to-one tutoring is done in every design school at some point during the education. Usually this takes place in the later years or in the final year of study, because this is a labour-intensive task which can only be done for a small group of students. The earliest example of one-to-one tutoring is the Greek term „scholae“, which is at the root of our word „schools“ and means that one scholar is educated by one teacher usually in a situation of walking and talking. This educational form can be found at post-graduate courses (see interview Rob van Kranenburg) and is also used in some institutions in the context of working on a thesis or dissertation.

Studio-based teaching is widely considered as a good teaching method. Compared to lectures it still needs a relatively high tutor-to-student ratio and therefore it is a more expensive setting. As it is a widely used method there are many ways it can be done which are reflected in a variety of names: design studios, ateliers, master classes, or the academy model of teaching are more or less synonyms. In the chapter on design education methods a full case study by Fiona Raby on her practice of studio-based teaching is presented. Studios are considered by half of the interviewees as the ideal kind of design education.

One element which is a widely accepted truth is that design education has to involve *practical exercises with feedback*; we can even conclude from the interviews that for most educators exercises are the central element in education. There are different views on the question what the role of theory in education is; some believe that theory leads to practice and some see it the other way round. However it can clearly be stated that there can be no design education which excludes practical exercises, and that good feedback to the students by the tutor is a central element of a valuable exercise. It is coaching, tutoring or tutor feedback which makes the difference between a simple training-on-the-job and a real education in a design school.

Finally, *lectures* are widely used and appreciated as well. Nearly half of the interviewees mentioned lectures when asked for their most-used ways of teaching. However, they are considered by most as a necessary add-on to provide information and to generate awareness and appetite for the discipline. Lectures must be complemented by practical exercises in design, they can not stand alone like in other disciplines. Lectures can not be the only teaching method in a design course. Similarly, one cannot be trained as a designer by only reading books. Also it is evident that for this reason there is no distance learning course on design available. The lack of personal contact with the tutor and the absence of exercises done in groups under supervision would be hard to overcome.

For an overview on the teaching methods mentioned in all the interviews see table 6. The dots correspond to the number of interviewees who have mentioned the method. Please note that the methods - with the exception of group work - have not been mentioned in any part of the interview guideline. So if a method has been mentioned three times, it means that three interviewees deliberately talked about this method. In a quantitative questionnaire it would be most likely that a higher percentage of the interviewees would state that they apply or have already applied the listed education methods. Here this is not the case as qualitative research with open questions has been used. Table 6 also lists the methods in a certain order, namely starting with the most labour-intensive „one-to-one tutoring“ at the upper left corner, and ending with the least labour-intensive „lectures“ at the other end of the list.

In the rest of this section a short overview on the highlights among the outcomes of this study is given. This overview does not claim to be complete and it is certainly subjective. A more detailed discussion of all issues is given at the beginning of the respective chapter, while the exact position of the interviewees can only be provided by the complete statements as made in the interview. For this reason none of the statements has been shortened or deleted from the text, and the full list of related statements of all interviews is still presented at the end of every chapter.

Didactics in design-related disciplines is different from didactics of most disciplines. The difference stems from the fact that design skills are not only based on the knowledge and application of well-known truths which are based on the findings of research. According to the interviewees an important factor of design education is training the ability to perform *value judgements*. This skill can be learned most effectively by doing practical exercises under the supervision of an experienced designer.

A whole cluster of questions in the interview guideline has been dedicated to *group work*. Besides the general question on favourite education methods, group work is the only method that has been explicitly addressed by the interview guideline. Like in most of the issues dealt with in the interviews there is a very broad range of answers. As the preferred group size nearly every imaginable group size is mentioned at least once. Some educators prefer individual work: Günter Domenig states that individual work is necessary at the beginning of the study in order to know the individual strength and weaknesses of the students. Also individual work is favoured by some educators in the later or final years of study where students already have collected a lot of competences. Work in groups of two or three students is widely used, but also larger groups of four to eight are mentioned (see table 7). There are exercises reported for groups of twenty or more students, but in these cases the group work has somewhat different characteristics. A typical exercise done in large groups would be a business simulation. Another example is the handover of projects described below. Ideally work in large groups is facilitated by an online platform that features a discussion forum and a tool for the exchange of documents. Interesting details on group work are reported in the interviews by Andreas Gruber and Urs Hirschberg.

An interesting method is the *self-evaluation or mutual evaluation* of work by the students. As it is typical for this study, this method can be seen in different applications and contexts. Rob van Kranenburg reports about positive experiences with the self-evaluation of group members and with mutual evaluation of student groups. In the context of design education a certain pluralism of opinions is certainly valuable. A designer presenting his or her work to the general public will face a broad range of reactions which can probably be simulated quite well by the opinions of a student group. The task of doing an evaluation is also helpful for designers, as they need to perform implicit value judgements all the time during their work. On the other hand, mutual evaluation of individual students can increase the objectivity of a tutor's individual grading of students. As the largest part of the group work has to take place outside the contact hours with the tutor, mutual evaluation of the individual contribution can be a valuable additional information for the tutor.

Another widely used and accepted method is to organise a *final critique session* usually called „final crit“ at the end of a term project involving practical work. At this critique session the students or student groups present the results of their work which is evaluated by two or more experts. One of them usually is the tutor who has coached the project. At least one is an external expert who has not seen the work before. External experts will add an important and different point of view to

the evaluation. This setting is in analogy to a jury at a competition. Also it is somehow similar to a milestone meeting during a larger project where the intermediate results are presented to a management team. In analogy to the handover techniques described below, a final critique session can be seen as „evaluation handover“, i.e. the tutor handing over a part of his or her evaluation task to external experts, which increases both the pluralism of opinions and the objectivity in evaluation. Final crits are described in the chapter on evaluation and in Fiona Raby's case study on studio-based education.

A good training method for design is the *handover of projects*. This is a didactical method based on the idea of creating interfaces within a design project or exercise. An exercise is divided into some distinct phases which are initiated and controlled by the tutor. Deadlines are given for completion of the phases. At the end of every phase there is a presentation and handover of projects. The results are presented in front of the group and every student has to take a different piece of work to continue with. The following example shows a possible subdivision of a design exercise:

- 1) Creatively fold or crumple up a piece of paper.
- 2) Take pictures of it.
- 3) Make sketches of it.
- 4) Find spaces in it.
- 5) Make a 3D simulation of it.

The selection of who will take over a specific piece of work can be done in different ways:

- A) At random
- B) Following a procedure based on student voting
- C) Following a procedure based on the tutor's evaluation

Project handover can be done in different time scales with handover intervals ranging from a few hours or days to a few weeks. It definitely has several valuable didactical aspects: Most prominently the students learn to interact with others within a project. They have to communicate the essence of their work and to capture the essence of the work of others. Project handover helps to dissociate the training of skills from an exercise in creativity or originality. Often the constraint to be original is considered as a danger to design education.

The method of project handover is emphasised in their interviews by Andreas Gruber, Rob van Kranenburg and Fiona Raby (see paragraph 9.203).

Another way of implementing a handover in design education is to have *presentations* of design work done by a different student than the one who made the design. The student who is the author of the piece of work will have to explain his or her work to a second student who will then have to present the work to a group of students and to the tutor. Usually there will be other external educators or practitioners listening to the presentation and contributing their view to the evaluation process.

This procedure has two main advantages: First the author of the design work will get immediate feedback on how his or her ideas have been understood by the student giving the presentation. This is an important point to learn from as usually the importance of a good oral presentation is underestimated by design students. This applies to technology students as well.

Secondly the effort of giving an oral presentation in front of a large group of people is disconnected from the effort of describing one's own work. The handover should make it easier to achieve both tasks in reasonable quality. However, as design students often have an introvert character and thus communication between them is often bad, handover is a good experience which helps them to understand how important it is to communicate the own design approach properly to colleagues, customers or the management. The method of presentation handover is reported in her interview by Fiona Raby.

In a special version of presentation handover the tutor will present the work of all students at the final critique session in front of all students and the critique jury. In this case the aspect of training presentation skills is pushed aside, while the necessity that the students communicate the essence of their work properly to the tutor is even more important, as in this case the student will usually be blamed for a failure in communication, not the tutor. This version of handover is used by Michael Szyskowitz at Braunschweig University. Furthermore it is reported by Fiona Raby who said that it is used at the Bartlett's and Architectural Association (AA) schools in London.

It is interesting to note that half of the interviewees run their own *private practice*. This was not considered as a factor when selecting the interviewees, but it turned out that way and gives us a good opportunity to compare the opinion of „outside practitioners“ and „non-outside practitioners“

among the design teachers. As mentioned earlier it is clear that with such a small number of participants it is not possible and not my intention to do any statistics and extrapolate the findings, which are nevertheless quite interesting. Not surprisingly we can see that it is exactly those interviewees who run their own private practice who are in favour of combining teaching with their practical work, e.g. to involve students in their projects.

Concerning the presentation of examples of their own work in lectures or seminars the picture is not that clear but it still looks like a correlation between e.g. the availability of buildings of their own design and the willingness to show them to the students. This is probably the case not only for design educators. Also in other disciplines it is likely that the quality of education and the credibility of a teacher can be enhanced by the use of examples from his or her own practice or research. For more details see chapter 5 on practical versus theoretical aspects in design education.

The notion of *interdisciplinary* work seems to be characteristic to design and therefore also dominates design education. It can be applied in two ways: First every design curriculum is a mixture of content from several disciplines. As pointed out by Czikszentmihalyi (1997) a crucial strength of a designer is the capability to combine knowledge or skills from different disciplines. Secondly it is important for a designer to be able to collaborate with specialists from other fields in a fruitful way. In technology-dominated tasks the collaboration in a multidisciplinary team is even central and stands at the beginning of every design process, as e.g. the UPA (Usability Professionals Association) User Experience Design Process (2001).

In my own educational practice my colleagues and I regularly establish co-operations between my students of Information Design and students of different disciplines, like e.g. Industrial or Product Design, Informatics, Management, and Psychology. For these co-operations a few conditions will facilitate didactical success: First a good understanding between the tutors and a good written briefing to the students is essential. Secondly a balanced mixture between contact sessions with the own tutor and networking sessions with the students of the other disciplines needs to be planned, while good time intervals for work in small groups between these sessions are provided. Thirdly it is very helpful to have a digital platform for the exchange of information between all involved parties, like it is described in the chapter on methods of group work. While interdisciplinary projects imply higher preparation and organisation effort for the tutors, this will pay back by a valuable learning experience for the students and by a high degree of learning from other students, which is an important factor under all circumstances.

During the last few years I have used different settings of multidisciplinary student teams. There has been a 1:1 setting - one student coming from two different study programmes, respectively - which generated satisfying results for all parties. There has been a 1:3 setting - one student coming from one programme, three students from another one - where in most of the groups the latter were not totally satisfied with the co-operation. Finally there has been a setting without cross-programme teams where students worked individually and used a digital platform for the presentation and exchange of their work. The last one was a very successful setting again. All three projects have been done from 2001 to 2004 in co-operation with courses led by Martina Molnar at the FH Joanneum's Industrial Design programme in Graz, Austria. The first attempt to create a similar co-operation with an Informatics programme did not generate any benefit. The platform was hardly used for cross-disciplinary communication and the projects ran in parallel without contact. This experience shows that cross-discipline projects can be valuable but in order to be fruitful they need careful planning and intensive supervision by the tutors.

Student exchange and studying in a foreign country is one of the few factors appreciated unanimously by all participants of this interview-based study. This is certainly not specific to design education, but due to the fact that a design task usually involves the consideration of culture-specific differences it is probably even more important for design than for other disciplines. The major implications of a smoothly organised student exchange are: A comparability of the different curricula like it is currently implemented in Europe by the European Credit Transfer System (ECTS); good contacts between schools in different countries established and maintained by the teaching staff, usually facilitated by the fact that teaching staff will meet at conferences or similar gatherings, but also by funded teachers' mobility programmes like e.g. the European funding programme Erasmus; and last but not least by the flexibility of the students and by the availability of funding, good information on the organisational aspects of the target location and low hurdles of bureaucracy. An analysis of the detailed answers is presented in chapter 13.

The answer to the question „*Does the education or training you offer fundamentally differ from your own one?*“ clearly shows that design education currently is in a period of change: The answer is „yes“ in all cases. However there are some interesting details. Two interviewees believe that students are more critical today or can express themselves in a free way. Two different interviewees believe that today's students are more pragmatic or instrumental than they have been in the 1970s when the interviewees have been students themselves. It is interesting to note that all these four interviewees

are between 40 and 50 years old. They probably draw a different conclusion because in the 1970s some of them still have experienced a traditional authoritarian didactical style, while others already faced the first attempts to introduce a free and democratic one.

The question concerning *future trends* and *challenges* and how to prepare students to face them generated an interesting set of answers. The architects among the interviewees state that architecture is at a crucial point and that their traditional job description disappeared. Six of ten answers are about technology and the changes in the architect's job caused by technology. Three of the interviewees mention the integration of other external factors, namely social factors, ecology, research, other design disciplines, materials, narrative and time-based factors. Mastering these factors will become an important skill in parallel to the traditional spatial, place and object-oriented factors. So design is currently in a transition to become cross-disciplinary and constantly more dominated by technology. Of course some interviewees also express the fear that architecture and the other design disciplines will lose some of their core aspects and been pushed aside either by technology or by pragmatic and goal-oriented or job-oriented thinking. The dichotomy between explorative science and design as „making“ is mentioned. At least some reassuring comments are made about design remaining stable in contrast to technology, or a consolidation that will take place.

Most of the interviewees interpret this question as regarding their discipline in general; only some of them emphasise the educational aspect of their discipline. However, most of the issues directly affect education as well. Like many of the questions raised in the present study, the question on future trends and challenges would deserve its own in-depth consideration, e.g. interviews, focus groups or workshops organised only for a discussion of this issue and its relevance to design education. This is why I consider this study to a large extent as unfinished work which bears the starting points for at least five related projects in it.

We can conclude that the interviewees are relatively unanimous in their view of the future. When asked how educators can prepare their students to meet these challenges, however, they propose some different approaches to achieve this. There is the proposal to educate generalists not specialists. Flexibility and adaptivity are emphasised as crucial competences. Two interviewees mention the importance of acquiring new skills without losing the traditional ones. On the other hand there is the proposal to dissociate design education from the training of technical skills. Like in the answers to the question before there seems to be an unsolved dilemma on whether to focus more on

application-oriented job training or in contrast on a general and non-specialised education. Maybe there is room for both views and the possibility to implement both believes in form of specific educational institutions, like it can be seen e.g. in Austria.

The majority of the design educators in this study believe that the reception of their work by the public is an important issue. They deal with it in their teaching and support the students in showing their work in public. On the other hand there is a difference made between architecture as a discipline which cares about the public and is made to be noticed, user interface design and interaction design as a discipline which has the end user in mind but is not made to be noticed, and art as a discipline which does not care about the public at all. Günter Domenig finally takes the extreme position that he is not interested in the public. While he is an architect he has the attitude typical for an artist. This is a logical consequence of his self-definition as an artist-architect.

According to the outcomes of this study the most prominent way of teaching design is studio-based teaching. It is typically done in groups of between twelve and twenty-five students supervised by one tutor. Like mentioned earlier the typical way of design education is characterised by the fact that the tutor will select out of an individual portfolio of teaching methods. This individual portfolio is again a subset of a large portfolio of didactical methods available in the discipline. Many of the methods, but not all of them, are also used in non-design disciplines. Methods generally are not well-defined and specified. They are subject to individual alteration and improvement and are adapted to the current needs and properties of the situation, like e.g. group size, co-operation possibilities, and available time. Iterative ways of design are prominent, like the ones described by Donald Schön (1983), Bryan Lawson (1994, 1997), and Henrik Gedenryd (1998) and referred to earlier in this text.

A few detailed case studies give insight to this issue.

- 1) Bryan Lawson's experiments he carried out with students of architecture and other disciplines. He tried to find out „how designers think“ and whether there are specific properties of the design process used in practice. He found the central role of the „primary generator“ as a starting point for the design process. Later he switched to the method of interviews which underlined this theory.

- 2) Starting from the work of Alexander (1964), Schön (1983), and Lawson (1997), among others, Gedenryd developed further the notion of inquiry as a parallel process of working on the definition and solution of a problem.
- 3) An experience I made when I assigned an identical user interface design task to three groups of students. Not only a different starting point was taken, but also during the process of this educational project that used problem-based learning (PBL) as a method, a considerable difference between the three groups became evident.
- 4) Another case study has been reported by Fiona Raby in her interview. She describes the way she and Tony Dunne lead their post-graduate studio at the Royal College of Art. A lot of insight into the setting, the challenges and the didactical approach is given by this case study.

Interview summary

Finally I summarise again the results of this study in a very short form.

- ✓ In most of the questions on design education there is no consensus among design educators, but a variety of well-justified opinions exist in parallel.
- ✓ Design education takes place to a large extent in classes of less than twenty students.
- ✓ When doing projects or exercises in groups, all group sizes from two students to eight students are possible and used.
- ✓ There is a wide variety of opinions both in favour of group work as well as against group work, i.e. preferring individual work.
- ✓ There is a wide range of possibilities how to grade and evaluate group work.
- ✓ Designers and design educators use earlier work of other designers as an example for themselves. There is no consensus, however, on whether showing and discussion of earlier work is a valuable method for design education.

- ✓ A dichotomy between theory and practice is only seen by a part of the educators in this study. Some see theory as a precondition for doing practical exercises. Others consider practical examples as a first step toward the consideration of theory.
- ✓ If an educator runs his or her own private practice, in our study this always seems to play a role in lectures or seminars.
- ✓ Only part of the educators are in favour of showing their own work in their lectures or seminars.
- ✓ Interdisciplinarity seems to be an important factor to all interviewed design educators.
- ✓ The role and value of students' creativity is seen in very diverse ways.
- ✓ Similarly, there is no consensus about the role and value of creativity methods or techniques.
- ✓ The role and value of students' talent is seen in very diverse ways.
- ✓ Design educators use several different kinds of design process models.
- ✓ Tests with users, e.g. usability tests, are hardly done by designers. Consequently they are only rarely part of design education.
- ✓ Trends in design and fashion are seen in very diverse ways.
- ✓ As the ideal way of design education all known kinds of institutions are named, with a slight emphasis on academies or master classes.
- ✓ All design educators in this study see a difference between the education they offer and their own education.
- ✓ There are all sorts of different grading and evaluation systems used in design education.
- ✓ Often the grading process in design education involves final critique sessions with external experts.
- ✓ In most design schools there are access limits. The value of access limits is seen in very diverse ways.

- ✓ All design educators in this study are in favour of student exchange. The best moment and duration is usually considered to be half a year in the middle of the period of study.
- ✓ Nearly all design educators in this study expect a further influence of technological changes in their discipline.
- ✓ Many design educators in this study take into account the reception of design in public.
- ✓ Questions of aesthetics as opposed to usability and economical factors are seen in a differentiated way. Regarding these issues there are no big differences between the opinions seen in this study.
- ✓ Regional aspects of design are seen in diverse ways.
- ✓ Most design educators in this study believe that women have equal opportunities in design.

We can conclude that only in very few questions there is a consensus of more than 90% among design educators:

1. The influence of having a private practice on teaching methods.
2. The positive attitude toward interdisciplinarity.
3. The difference between the own education and today's design education.
4. The high value of student exchange or studying abroad.
5. The view of the future where an impact of further technological change is expected.
6. The consideration of the public opinion.

In all the other issues discussed in this study, or in other words in all important issues of design education, there is no consensus among design educators. It appears that design can be educated successfully in a variety of ways and based on a wide variety of methods and believes. It looks like *individualism or the prominence of the educator's personal style and personality* is the single most important common denominator in design education. This is probably the most interesting finding of this study.

At the end of this text the detailed findings of this study are once again summarised in a graphical representation which includes all questions.

Table 44 (following pages): Overview

interviewee	1 Dom	2 Ehn	3 Gru	4 Grü	5 Heu	6 Hir	7 Kip	8 Kra	9 Raby	10 Szy	11 Zim
teaching small groups (seminars)	y	y	y	y	y	y	y	y	y	y	y
teaching large groups (lectures)	(y)	y	y	y				y			
activity as thesis supervisor	(y)	y	n	n	y	y	y		n	y	y
preferred teaching methods											
preferred group size											
1 (individual)	1				1				1		
2 to 3					1	1	1				1
3 to 4			1								
4 to 5								1			
4 to 8		1									
20 to 50		1				1				1	
other				1						1	
group work											
positive aspects of group work		y	y		y	y	y			y	y
problems with group work		y	y	y	y	y	y			y	y
preconditions for successful group work	y	y						y			
grading of group work											
individual grading		y			y			y			y
mixture of individual and group grading		y	y					y			
all group members get the same grade	y		y	y	y		y				
teaching by "gurus"											
individual examples for own work	2	1	6	1	1	3		2	1		2
institutions, countries						1	1			2	
use of gurus' work in teaching	y		n	n	p	p	p	p	y	y	n
conflict between theory and practice											
there is no conflict	y		y	y	y		y		y		
there is a strong conflict		y				y		y			
theory and practice in education											
emphasis on practical exercise			y		y		y		y	y	
balanced	y	y		y	y	y	y	y			y
emphasis on theory				y		y		y		y	y
relationship teaching and own practice											
has private practice	y	n	n	n	y	n	y	y	y	y	n
combine teaching and own practice	y	n	n	n	y	n	y	y	(y)	y	n
present examples of own work in seminar			n	p	p	p	n	y		y	p
combined relationship teaching-practice	y	n	n	pn	py	pn	py	y	py	y	pn
interdisciplinarity											
works in original discipline	y	n	y	n	n	y	n	n	n	y	n
interdisciplinarity in design education	y	y	y	y	y	y	y	y	y	y	y
creativity											
creativity is very important			y		y					y	
creativity is helpful						y	y				y
creativity is over-rated				y					y		
creativity											
use of creativity techniques			y	y	y	y	n	y	n	y	y
role of creative design in teaching	y		p	n	y	y	n		y		
can creative design be learned / taught	n	p	y	y	n	p	p	y	y	p	p

where is it better to learn to design												
at a school		y								y		
both in part			y		y							
at practical work												
design process												
do you have a specific process model	y	p	y	n	y	n	y			y	y	n
teaching evaluation or test methods	n		n	p	y	p	n			y	p	
design movements, influences												
individual examples for own work		5	y	3	1	5	3	1				
institutions, countries, groups		1			1	1	1	1		1		
design movement reflected in teaching	p		n	n	n	n	n			y	y	
ideal kind of design school												
scholae										y		
post-grad., atelier, studio, academy, master class	y	y			y		y		y	y		y
university			y	y		y				y		
comparison with own education												
is design education better now than before	y	y	y	y	y	y	y	y	y	y	y	y
students are more critical now, can express th.			y	y								
students are more instrumental, pragmatic now							y	y				
small groups better than mass university	y				y							
grading												
steps on grading scale		6					5	9	3	13	5	
final crit (critique session) with external experts	y	y	y		y	y	y		y	y		
does it make sense to grade design skills	y	y	n	y	y	y	y	y	y	y	y	
thesis evaluation		p			p	p	p				p	
grading as a jury member					p	p	p				p	
criteria for grading	p	p			p	p	p			p		
participation, motivation, form, presentation		n	y	y	y	y	y			p	y	
is objective evaluation of design possible		p	p	p	n	n						
is obj. eval. of earlier works of art possible		n	p	y	n	y						
mutual evaluation by students	y	y	p	y	y	y				y	n	
access limits to seminars or school												
are there access limits to your seminars or school	p	y	n	y	y	p	y	p	y	y	y	
what are the effects of access limits	p	y	n	p	y	p	p			p	p	
student exchange												
how valuable is student exchange	y	y	y	y	y	y	y	y	y	y	y	
optimum one semester or more in middle of study			y	y	y	y	y			y	y	
future trends and challenges												
traditional job disappears, technology dominates	y	y	y	y	y	y	y			y	y	y
adaptive, flexible, dissociate design and tech skills		y			y	y	y					
aspects of public, economy and gender												
influence of public reception of design in teaching	n		y	y	y	y	y			y	p	
conflict aesthetics - usability of a product	p		p	p	p	p	p			p	p	
conflict aesthetics - economic aspects			p		p		p			p	p	
relevance of regional aspects for design			n	y	p		n			y	y	
gender-specific equal skills in design	y		y		p		y			y	y	
gender-specific equal opportunities in design	y		y	n	y		y			y	y	
men still dominate technology and industry			y									y

When we consider the results of this study we could conclude that many of the didactical approaches described here are not only applicable to design education but to several other disciplines as well. In my opinion this is only true if all the conditions are equal, like group size, contact hours per week, dominant style of thinking of the field, interdisciplinary approach, application-oriented teaching. If in a discipline it is essential to learn a lot of facts that are presented in a lecture or can be learned out of a book as well, such a discipline would probably have different didactical requirements than design. Also a discipline where the success of a student can be measured more precisely than in design would require different grading and evaluation methods. So the findings presented here are certainly not limited to design, but their application is limited to disciplines which share all relevant characteristics with a design discipline.

In this study women are under-represented on the side of the interviewees. The percentage of female interviewees is probably not far from the percentage of female professors or practitioners in many technical or design disciplines. This is definitely a big mistake and needs to be changed. I tried to make a small contribution to this important task by including questions and a chapter on gender aspects into this study.

The reader may expect from this study to get a list of concrete recommendations for design education. While this would be highly desirable, such a list cannot be generated at the moment and will probably never exist. Instead, it is the nature of design education to have a broad range of different methods available. From this range the educators select an individual portfolio of methods which they usually modify or combine individually. Here, again, the criteria for selection, combination or modification of methods are, among others, the group size, the available tutor-to-student ratio, the available contact time per week, the overall seminar duration, and the level of the students.

This study and planned follow-up activities can help to document design education methods without the false attempt to standardise them, and to facilitate networking and communication among design educators on an international level. This task will never be completed because of the nature of design disciplines but remain ongoing. The support and maintenance of a lively community, however, is always a good basis for advances in a discipline.

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Curriculum Vitae

Konrad Baumann has a Master's degree in Telematics Engineering from Graz Technical University. He currently is a full-time professor in user-centred design and usability engineering at the FH Joanneum's (polytechnic) School of Information Design in Graz, Austria. In this position he regularly supervises diploma theses in co-operation with industry, e.g. Siemens, Philips, and BMW. At FH Joanneum he is co-leader of the major Media and Interaction Design. Furthermore he is an external lecturer at the Donau University's department of Telematics Management in Krems, Austria.

He is co-author of two books: K. Baumann & B. Thomas „User Interface Design for Electronic Appliances”, Taylor & Francis 2001, and K. Baumann & H. Lanz „Mensch-Maschine-Schnittstellen elektronischer Geräte“, Springer 1998.

Konrad Baumann is secretary of IFIP Working Group 13.1 on HCI Education. He is a member of the following professional societies: ACM-SIGCHI (Association for Computing Machinery Special Interest Group for Computer-Human Interaction), BCS-HCI (British Computer Society), UPA (Usability Professionals Association), IFIP (International Federation of Information Processing) und OCG (Austrian Computer Society). His fields of interest are HCI and design didactics, usability engineering and user interface design for appliances.

In 2001 he initiated „Web Usability Center“, a funded research project offering usability-related consulting for companies, which he led for two years. He offers consulting services for industry, e.g. he regularly moderates focus groups.

Before starting to teach he worked as product manager with Mikron Identification, Philips Semiconductors and Philips Consumer Communications in Vienna, Austria, where he was responsible for the user interface and usability of fax machines.

Lebenslauf

Konrad Baumann hat an der TU Graz Telematik studiert. Er war anschließend bei Mikron Identification Gratkorn, bei Philips Semiconductors und bei Philips Consumer Communications in Wien tätig, wo er als Produktmanager für User Interface und Usability von Faxgeräten zuständig war.

Er ist Co-Autor der beiden Fachbücher K. Baumann & B. Thomas „User Interface Design for Electronic Appliances“, Taylor & Francis 2001 sowie K. Baumann & H. Lanz „Mensch-Maschine-Schnittstellen elektronischer Geräte“, Springer 1998.

Seit 2000 unterrichtet er hauptberuflich User-bezogenes Design und Usability Engineering am Studiengang Informations-Design der FH Joanneum in Graz und beschäftigt sich in seiner Lehrtätigkeit mit benutzerorientierter Gestaltung technischer Produkte. 2003 wurde ihm der Titel „FH-Professor“ verliehen. Er leitet gemeinsam mit O. Kipcak die Vertiefungsrichtung „Media and Interaction Design“ des Studiengangs. Er betreut Diplomarbeiten, die vorwiegend in Kooperation mit Industriepartnern durchgeführt werden, wie z.B. BMW, Siemens und Philips. Seit 1999 hat er regelmässig Lehraufträge an der Donau-Universität Krems.

Konrad Baumann hat das Projekt „Web Usability Center“, das Usability-Consulting für die Wirtschaft anbietet, im Jahr 2001 initiiert und zwei Jahre lang geleitet. Er bietet User-zentriertes Design als Dienstleistung an, u.a. moderiert er regelmässig Fokusgruppen. Er ist Initiator einer Arbeitsgemeinschaft für benutzerzentrierte Technologie an der FH Joanneum.

Konrad Baumann ist Sekretär der IFIP Working Group 13.1 für HCI Education. Er ist in den folgenden Fachorganisationen aktiv: ACM-SIGCHI (Association for Computing Machinery Special Interest Group for Computer-Human Interaction), BCS-HCI (British Computer Society), UPA (Usability Professionals Association), IFIP (International Federation of Information Processing) und OCG (Österreichische Computergesellschaft) und ist dort im Bereich Didaktik der Human-Computer Interaktion sowie Usability of Appliances engagiert.

