

RESEARCH SKILLS AS BASIS FOR INDUSTRIAL COLLABORATION IN DESIGN EDUCATION

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ABSTRACT

The Changing role of the design profession requires a broad set of techniques from the practitioner. The designer is no longer just a professional who knows how to build representations for artefacts, more than before he must also understand to perform as a mediator of interdisciplinary teams or as a researcher in adjacent disciplines. The design practice, when it is concerned with strategic product development is linked to innovation techniques, which derives from human factors as well as from information sciences or engineering. Therefore it remains the responsibility to the Design education to foster the curiosity for different approaches of design. Designers have to come up with knowledge for methodological design approaches for problem understanding and problem solving.

In order to ensure the ability for research and leadership in design, design education has to develop new models of teaching and learning.

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1 NEW CHALLENGES FOR THE DESIGN PROFESSION

1.1 A need for scientific thinking

Designers are asked to perform as advocate of the user, innovator of processes, construction and form, as marketing specialist, and of course as the responsible for the aesthetic appearance of artefacts. Designers have to play all these roles in the everyday practice. Therefore design is regarded as a discipline that is able to moderate within multi-discipline areas of product development. But with the focus on mediation the designer gains the responsibility to structure projects and give methodological advice. Quite a paradoxical situation for a profession which cannot claim a certain methodology it's own.

As is recognized by NextDesign [1] designers are still concentrating on the WHAT, the output that is expected from a project. Meanwhile the HOW, the way a result is created, remains unreflected. Since there is seldom any scientific need to write down the process of a design project, the creative process seems to be somehow intuitive and unrepeatable. No articulated method seems to be applied in the design process though the result is often based on a set of individually developed tools that suit the situation and the briefing. What is lacking when it comes to project strategies in the design practice is the reference on established tools or scientific background. Though there is no point in saying that the designer does not apply any method at all, it has to be

acknowledged that frequently the procedure is not clear and defined nor is it based on scientific sources like case studies, fundamental research or analysis. Designers still refer to tacit knowledge that is typical for individual artistry, but cannot be shared. A culture of scientific thinking and responsibility is needed to ensure the accumulation and accessibility of methods.

1.2 Two branches of professionalism

With the growing complexity of challenges in the design practice, the professional field seems to split in two branches of design practice. The designers of the one branch focus on the artistic aspect of design and act as design-authors who supply the market with a repertoire of distinctive forms. This group is mainly represented by individual designers who are mostly personally known (i.e. Morrison, Newson, Starck, Grcic etc.) or small design studios whose identity is based on individual competence, rather than a general methodological approach and trans-disciplinary work. Their ability to generate aesthetic quality is the basis for their success on the market.

The other branch instead offers their clients a set of possible approaches for particular design challenges. In general, larger design studios, which combine various professions, take this approach. Depending on the studio's profile designs and design strategies are developed on the base of research results, or technical innovations. Projects in this context are generally complex and require attention from different perspectives. Knowledge in humanities and research methodology are required, when it comes to the design of i.e. medical environments or medical tools, communication devices or services. Marketing experience and design management is needed for strategic product development and branding. In those scenarios designers need to reflect this complexity within interdisciplinary teams, because the discipline design is not able to accumulate all necessary knowledge on its own. For this reason, investigative design studios like IDEO or Design Continuum extend their professional competence of industrial and communication design, marketing, management and engineering with knowledge from human factors, like anthropology or psychology.

While designers who follow the first branch will still be successful in the tradition of artistic action, redesign and styling, they will hardly convince as project leaders conducting research based projects in trans-disciplinary teams. In order to give designers the competence to perform as leaders in the innovation process, according to NextDesign, there has to be a new and deeper understanding and communication of the HOW. Designers who will professionalize in methodology as well as in form giving and representation will be more likely to convince as strategic connoisseurs or consultants. If the future requires a different design competence, how can this be fostered?

1.3 Challenges for the design education

At the time the design profession requires more methodological knowledge of some designers, design education is responsible to adapt to these needs. Design education models that pursue a shift into the direction of project lead should therefore concentrate on the following challenges:

- Generate transparent design methodology in education.
- Conduct projects with industrial collaboration.
- Provide a science based design education on various levels.

While the first aspect should supply design students with a set of approved approaches of research, evaluation, creation, and representation methods, the second aspect gives students the opportunity to practice their knowledge under professional circumstances. The emphasis on science based design education is not only important to broaden the intellectual horizon of designers. Training in scientific work gives designers the possibility to summarize their reflections so that it can be archived and made accessible for future needs.

2 TRANSPARENT METHODOLOGY AND DESIGN EDUCATION

It can be observed, that there is a new need for designers to develop and articulate certain knowledge in methodological approaches. While an almost surgical step-by-step problem analysis was the tool for designers in the 1970s [2; 3], the profession today seems to require a different and more holistic understanding that is based on situational needs. Gedenryd already pointed out, that the early design methods from Alexander and other logical researchers hardly coincide with the methods actually used in the design studios. [4]

As Umberto Eco mentioned in his introduction into semiotics, the designer – in Eco’s case an architect – is always obliged to act as a different person, i.e. as sociologist, politician, anthropologist, psychologist or semiologist, depending on the perspective from which he observes the problem. [5] That he performs in teams does not necessarily change the situation. The designer is still responsible to understand the context in its various forms. Therefore it is not surprising, that design, as analytic and creative discipline, needs a multitude of techniques to analyse the context in which it is supposed to act. But still there is no original design methodology – and probably there will never be any. Instead designers use and transform the knowledge that seems to be adaptable for their tasks. From environmental and Gestalt psychology to ergonomics and user analysis, from semiotics and systems engineering to scenario building and management, design borrows tools for its procedures. Combined with the typical design competences such as prototyping and visualisation an efficient set for problem understanding and innovation is generated.

Though many design studios use at least parts of analysis, evaluation and creation techniques from other disciplines in their daily practice, there are rarely summaries found that describe the design process. Procedures of product development are chosen and applied just in time. Critical descriptions or reflections about the design method seem to remain in the dark. One reason for this might be that, distinct to design science, an individual design business has to keep its secrets to supply its clients with a singular approach. Also design studios do not spent resources on writing without being paid by a client. In those cases economic interests block the spread of methodological insight.

In the university context the reverse tactic has to be practiced. Procedures and methods have to be as transparent as possible. Otherwise students will be loosing sight of their goal, which should be learning and understanding the design process. The task of design education is to reveal the circumstances under which a good product can be created. In order to foster a deeper understanding of the HOW, design students should be taught to reflect their procedure in detail. Discussions about the way the output was generated, how the HOW influenced the WHAT, enables to understand and estimate the value of different procedures.

Certainly it will not be possible to describe in an abstract way the method for optimised design. But it is possible to illustrate with case studies, how well a project went because of a specific set of methods that was applied. Tom Kelly’s revealing book “The Art of

Innovation” [6] gives an insight on how IDEO conducts a design process. This rare example of a design studio, which publishes its secret knowledge, offers students a useful toolbox out of which they might select some methods for their next project. The fact that the demonstrated application of the creative tools brought up real and innovative products encourages the students – especially undergraduate students – to follow the demonstrated path of structure, instead of intuitive action.

In the educational context, further design studies could be undertaken and systematically analysed. This would train students to understand the strengths and weaknesses of the various approaches and could make them sensible for context relevant methods. While in undergraduate courses investigative and analytical studies are more likely to be guided carefully by a teacher, on graduate level it is required that students conduct their own research projects on which they reflect analytical methods and their impact on the creative output.

The outcome of the projects and the critical reflection gives the students, their colleagues and the faculty members useful input on how to continue research in design. For their studio years after graduation, research experienced design students will be prepared with strategic knowledge and a sense for complex problem solution.

3 INDUSTRIAL COLLABORATION IN THE DESIGN EDUCATION

Important impacts on methodological education in design depend on the type of projects offered by the faculties. One possibility to practice and evaluate methods in design is to develop projects within the scientific context of the university. On the one hand projects can be conducted in collaboration with other faculties than the design faculty. Cooperation with departments of engineering is probably the most common example for this case. On the other hand research collaboration with industry is the key factor for methodological exercise in design studies. For an industrial partner design output has to be generated through a transparent approach. Intuitive action that is based on tacit knowledge hardly convinces the clients.

One recent example for the approach of faculty cooperation demonstrated the department of industrial design with the centre for fuel cell technology (ZBT) of the University of Duisburg-Essen. The ZBT created a technological system for auxiliary power units (APU), which supply energy in areas of difficult access. This innovation was developed without any scenario as a background. As an engineering result there was only the technology that could be demonstrated. In order to make the technique easier understandable a product had to be invented. Now the designers introduced a new product concept for the APU and designed a power supply on sailing boats. The strategy was to use the know how of design to introduce a technical innovation into the world of products. The designs pictured the technical qualities and the scenario reflected the practice relevance of the innovation. Through the design the APU concept gained a representation that made the innovation easier to communicate. Unusual for a technical product, the APU was presented to the public for the first time in the context of the international fair ‘boot’, only secondly it was shown at the more technical ‘Hannovermesse’. This example referred to a rather styling oriented design approach and required the classical design competence of shaping and visualisation. Nevertheless the technique of scenario building could be successfully practiced and proved with an existing demand.

Some other projects at the University of Duisburg-Essen are conducted with the aim to optimise and innovate through empirical research and design. Most of them are guided by the Institute for Ergonomics and Design Research (IED). The IED accompanies

projects within the fields of medical care, engineering, urban studies or information technology. In collaboration with companies such as Daimler Chrysler, Ford, Deutsche Telekom, Eppendorf Instruments or Siku, new concepts for human centred products, interfaces or environments are commissioned. Within small teams of professors, assistants (PhD students), graduate students and professionals from the collaborating company, design research is done for current problems or scenarios for upcoming technologies. The complexity of most problems requires a careful analysis and a science-based investigation as basis for design concepts. A definition of criteria for a human centred design approach for the specific problem has to be developed through adaptation of knowledge from the state of the art in human factors and clinical research.

Research experienced staff is obligatory for this kind of work. From the participating students it is required to have accomplished their basic courses in design theory, ergonomics and other research oriented topics. Depending on the cooperation duties, students might be employed by the IED for the time of the project. That will encourage their responsibility for the outcomes and assures scheduled working. During the projects the students will learn how to analyse a situation with methods that are usually related to human factors, psychology and sociology. They get to learn observation techniques and how to create effective questionnaires for interviews. They will explore methods of participative design as well as workshops with clients and users. The knowledge created through an examined situation the researchers will compare with the state of the art in ergonomics and technology and transform the information into a human centred design approach. The science-based design view on the client's problem opens the partner's eyes for new inspiring approaches of strategic product development. Sometimes the studies conducted merge into new products; sometimes they inspire new directions for further research.

One example is the development of a new concept for a user related remote control for toy cars that are bought by children as well as adults. Based on an analysis of the various ways of the remote control's functions a variety of interfaces were prototyped and tested according to ergonomic standards. Selected buttons were developed further and implemented in the final prototype, which was tested again for user acceptance. The result is a sophisticated device with which a complex set of functions can be controlled intuitively. From the ergonomic approach the step to a well-designed product was pretty small. Nevertheless the design competence was essential to create a project for the two target groups – playful children and technique loving adults. The methods used in this project are quite transferable. Similar approaches were used i.e. to create new concepts for electrical devices for liquid handling.

The example of design research at the IED illustrates one opportunity, how design faculties can practice methodological procedure in collaboration with industry. While it provides students with the opportunity to practice research in a realistic environment, the industrial partners receive research based design strategies or designs. With the focus on advice, rather than design, in this kind of collaboration designers are rather consultants than artists. This consultant role for the designer demands a reflective action that is based on more than just the classical design experience. After Friedman, "The challenge is to shape an effective process of design that yields effective outcomes. This must be an inquiry-based process, a problem-solving process linked to effective methods for design development." [7] If design faculties want to engage in industrial collaboration a shift to a more science based design education is needed.

4 SCIENCE BASED DESIGN EDUCATION

4.1 Continuous curriculum adjustment at the university of Duisburg-Essen

As was mentioned above, even undergraduate students need a certain amount of research training, if they will be able to support projects within industrial collaboration. Because most German design departments are located at universities of applied sciences or art academies, it seems to be often difficult to implement a profound education in research skills. Mainly this is due to the restricted resources of adjacent disciplines beside the art related ones available at those colleges. As one of the few research oriented 'design schools' in Germany, the faculty of art and design at the University of Duisburg-Essen is strengthening its profile and continuously optimizing its curriculum towards a research oriented design education.

The design education in Essen looks back on a long tradition, which has developed from rather practice-based studies in art and design to a highly academic profile. [8] Since the design department from the Folkwang Hochschule für Gestaltung was integrated into the university in 1972 the design education shifted from a crafts oriented approach to a multidisciplinary design education. In the department of industrial design the curriculum defines a variety of classes in engineering, ergonomics, design history and design theory, philosophy, psychology, marketing and project management. With this background as completion to the classical design courses in representation, studio work and design basics the students get prepared for individual project work. It is recommended that the students combine some of their theoretical courses with design projects, so that it will be easier for them to understand, how the disciplines interact. Reference projects for the combination of theory and design are like the ones described above with the focus on ergonomics.

4.2 Personal motivation for research in design

For the students the science-based design approach is often a stimulus for further research work in their fields of interest. The award winning ct-loop [9] is a good example for this phenomenon. On his personal motivation, the student Benjamin Holch conducted research in the field of medical environment and designed a new computer tomography for his diploma degree. The information Holch generated through his observations and interviews he later used to invent optimised hardware arrangements for patient handling and user-centred interfaces for the high-tech black box, computer tomography. The key innovations were generated by a careful observation of the patients needs. With the design-view on this engineering dominated scenario Holch created features that will make the examination with the ct-loop friendlier for the patient, i.e. a ceiling-projection of the examination process and a self cleaning mechanism for the stretcher. Though the research Holch conducted is – once again – not documented for public access, the design would not have been as qualitative as it is without the research phase at the beginning of the process.

4.3 Research opportunities on higher levels

After design studies with a scientific background, some graduates search for a career, where they can continue their research studies on a profounder level. The current number of applications for PhD studies in design sciences at the University of Duisburg-Essen reveals the necessity of further post-graduate studies in design. Since the possibility for a doctorate in design sciences was established in 2001, the faculty registers more and more applications for this option. Until now the offers for post-

graduate education still do not supply the want. The faculty is developing a strategy to work out more opportunities for PhD candidates and other post-graduate studies.

The Institute for Art and Design Sciences (IKUD), which was founded to foster the scientific approach in the theories in art and design created a platform for discussion in design theory at the University of Duisburg-Essen. While the discussions used to concentrate on art and design in a historical context, the current aim is to open the discussion for more methodological thinking. The Institute for Ergonomics and Design Research relates the more practice-oriented challenges from the industry to design science. Currently an international group of 10 PhD students is working at the IED. With this profile the faculty of art and design at the University of Duisburg-Essen hopes to advance its approach to provide a future oriented design education, a design education that will suit the demand of leading professionals.

5 CONCLUSIONS

For a future oriented design education, design colleges should be aware of the two important directions of design professionalism, which are either authorship or trans-disciplinary research and design. While the first exists and will survive as an artistic approach, the latter has still to be developed into a direction that suits the demand of a leading profession. In order to improve the understanding of the HOW, design colleges are asked to supply methodological advice and courses in design related sciences from their undergraduate classes onward. Only with this basic knowledge design science can be accepted in the scientific world.

The methodological skills students have are the basis for successful collaboration with industry, which is looking for research based design strategies. Students cannot provide all needed methodological knowledge, when it comes to professional collaboration, but a certain scientific background has to be taken for granted. Nevertheless, student research in a real project is a tremendous tool for exercise. Within collaborative projects design students can practice relevant design research under real conditions. This experience also trains in project management, a skill that cannot be overestimated for the professional designer.

The approach of research training and practice seems to be reasonable for two reasons. Pretty soon it benefits forthcoming design studios for their professional demands. In the long run, there will be more scholars in design who will enter in academia, which will have a positive impact on the education at all design colleges.

At the University of Duisburg-Essen we will start new trans-disciplinary projects with other faculties and extend the collaboration with industry. For post-graduate students we will work on further programs for doctoral studies. The aim is to establish a post-graduate course (Graduiertenkolleg) with a design topic that will relate sciences from design, humanities, human factors and engineering. Researchers from all mentioned disciplines shall guide this PhD program. Another step will be the generation of even deeper methodological understanding during undergraduate years. For this purpose the faculty discusses to dedicate more attention to methodological awareness in the design courses.

Of course not all aspects can be educated in the frame of a classical department of art and design. But further models emerge to supply some missing contents. The University of Duisburg-Essen is cooperating with the recently founded Zollverein School of Management and Design, which offers master courses in business administration with a focus on design. In the future there will also be the possibility for PhD studies and

management related collaboration with industry. This is certainly another promising approach of preparation for design leadership.

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