

# Creativity as Practice(d) in a Design Studio

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**Abstract:** Although the social and cultural dimension of creativity has been emphasized for quite some time, there is neither a consensus on how creativity can be nurtured nor on what it is to become creative. Adopting a practice-oriented perspective, this paper reports on an ethnographic study in a studio-based course on Interface Design. Drawing on observations and students' narrative accounts of their working processes, the local design studio is portrayed as a well-attuned system of structural elements, patterns of interaction and epistemic assumptions. The findings reveal basic similarities but also significant differences with other studies on educational design studios. It is suggested that these differences are due to differences in the epistemic frames enacted.

## Introduction

Creativity has become a vital and highly valued aspect of science, technology, the arts, as well as the everyday life (e.g. Craft, 2011). It has been argued that the increasing interest in creativity is due to a global shift towards a knowledge-based society and innovation driven economy (Sawyer, 2008). As a consequence the question on how to promote creativity is of interest for policy makers and curriculum developers alike (Sawyer, 2012). However, creativity is not just relevant to ensure economic growth but also to address urgent social and ecological problems and to enable individuals to actively cope with the volatile, provisional, and precarious life-worlds they find themselves in. Creativity in this sense is not just a skill to be used in predefined settings and aimed to increase performativity, but essentially "can challenge the *status quo*" (Craft, 2011, p. 28). Adopting the conference's theme, it is hence important not only to ask how creativity can be nurtured but also what it is to become creative.

This paper reports on an ethnographic study carried out in a one-semester course in the study program on Industrial Design at the Muthesius Academy of Fine Arts and Design in spring 2013. Adopting a practice-oriented perspective, in which creativity is "seen as a mode of human interaction with the world" (Beardon, Ehn & Malmberg, 2002), the goal of the study was to describe respective patterns of interaction enacted by the students and the teaching staff and to trace the underlying epistemic frame in a design studio setting. The setting was chosen because design education in general and the design studio in particular is supposed to be geared towards the cultivation of creativity and should therefore promote respective practices. However, due to the situated nature of practices (e.g. Schatzki, 2012), the intent of our analysis is not to unravel general principles of creativity but to shed light on the meshwork of practice enacted in a particular pedagogical setting. Drawing on (1) observations of the actual doings and sayings of the students and the teaching staff during the contact hours, (2) students' narrative accounts of their working process and procedures, as well as (3) the material arrangements and artifacts present and utilized, the analysis shows how students work on the horizon of their (and others) knowledge, bring in personal perspectives and make deliberate use of the opportunities they spot to respond to the design challenge given.

The contributions of this study to the learning sciences are threefold. First, the study provides an account of the patterns of interaction occurring in a genuine pedagogical setting, hence adding to the overall educational case base. Second, it backs up the assumption that professional practices draw on specific epistemic norms (cf. Shaffer, 2004) and therefore challenges paradigmatic orientations in education. Third, it provides ideas on how creative practice might be nurtured within design but also in other domains.

## A Practice-Oriented Perspective On Creativity

The concept of creativity has been an object of concern for quite some time across various disciplines (e.g. Hennessey & Amabile, 2010). While the social and cultural dimension of creativity has been emphasized since the 1980<sup>th</sup> current conceptualizations of creativity often still build on a model of the social as "an external environment, a set of stimulations that facilitate or constrain the creative act" (Glăveanu, 2010, p. 85) instead of conceiving creativity as an inherently social process. Similarly, most of the current accounts also hardly account for the way creativity is mediated by material artifacts and environments (e.g. Vyas et al., 2009).

The conceptual framework for the present study is therefore based on a practice-oriented perspective on creativity. From this perspective creativity is neither a property of a person, process, product, nor environment, but a way of interacting with the world. More precisely, creative practices can be understood as those modes of interaction in which individuals or collectives aim to cope productively with an otherwise

indeterminate situation, i.e. a situation that is inherently disturbed, confused, ambiguous, or unsettled (cf. Miettinen, 2006).

Drawing on the work of Schatzki (2001, 2012) and Hörning (2001, 2004), we take practices as the central unit of analysis, which are understood as “embodied materially mediated arrays of human activity centrally organized around shared practical understanding” (Schatzki, 2001, p. 2). A practice-oriented perspective holds that human action is not a sequence of self-contained intentional acts realizing preconceived plans but an ongoing process in which the human actors actively frame, respond to, and transform the situations they find themselves in, making use of the artifacts and resources available. Competent action in this sense entails both an adaption of the individual to the environment s/he is acting in, giving rise to habits and routine ways of doing things, but also procedures that allow the actor to cope with those situations in which established habits do not work. Social practices, including creative ones, are neither an accumulation nor an abstraction of individual acts, but those patterns and styles of action that emerge from repeated interaction, allowing the participants to form shared expectations on how to act in a certain situation (cf. Hörning, 2001). Social practices hence can be understood as the conventions and arrangements enacted by a certain group of people at a certain point in time. As practices cannot be separated from the concrete doings and sayings of the practitioners and the material assemblages in which these take place, particular practices are necessarily local and historical. Accordingly there is no such thing as a creative practice, but a multitude of creative practices enacted in various settings. Furthermore, as situations are usually open to different interpretations, they require an active framing of those engaged in them. Enacting a social practice therefore requires not only practical knowledge, but also knowledge about the overarching schemes that allow actors to interpret and define the situation they find themselves in (cf. Hörning, 2004). The practical know-how as well as the interpretive schemes can be understood as repertoires the actors use to cope with the situations they are facing.

Learning to become creative hence is about learning to engage in the continually evolving process of a creative practice. From a practice-oriented perspective on learning “the practitioner is an embodied subject produced through participation in practices that shape skills, knowledge, understanding and disposition to action” (Hager, Lee & Reich, 2012, p. 7). Learning to be creative is a situated process entangled with the development of the learner’s identity. In this process learners not only develop an understanding of the domain and practical know-how but also interpretive schemes to draw on when facing a certain situation. An important aspect of these schemes is what Shaffer (2006) has called the epistemic frame. Epistemic frames are “the ways of knowing, of deciding what is worth knowing, and of adding to the collective body of knowledge and understanding of a community of practice” (Shaffer, 2006, p. 223). Such frames might intersect and overlap with traditional disciplines but are essentially bound to local practices and continually transformed by their enactment. Learning therefore is not to be understood as a reproductive but as an inherently transactional process in which the learner as well as the context are evolving.

Against this background, the research agenda we pursue is not geared towards the identification of general principles of creativity but aimed to describe how creativity is practiced in a concrete educational setting. Trying to trace the underlying epistemic frame the present study aims to shed light on the utilization and creation of knowledge in creative design efforts as well as its impact on the practitioners.

## Research on the Design Studio

The design studio has been variously identified as common denominator and essential constituent of design education across the disciplines (e.g. Brandt et al., 2008; Wang, 2010). The design studio is characterized by (a) open-ended projects the students work on over a prolonged period of time, (b) various types of structured review or feedback sessions focused on the evolving project work, and (c) a public presentation of the project outcomes (cf. Shaffer, 2003).

Even though some authors have depicted the design studio as a distinct and consistent pedagogical approach (e.g. Kuhn, 2001; Brandt et al., 2008) it has been argued that there are apparently significant differences regarding both content and methods in studio teaching between schools and even within departments (e.g. Ledewitz, 1985). In fact various alternative models for design studio teaching have been proposed building on substantially different assumptions on the nature of design and the role of the designer (e.g. Dutton, 1987; Ledewitz, 1985; Wang, 2010). Ledewitz (1985) already suggested that the practices actualized within the design studio depend on the stipulated model of design. In a more recent interview study Carvalho, Dong & Maton (2009) found that design disciplines not only differ with respect to the domain knowledge they deem relevant but also with regard to the epistemic assumptions they build upon, a fact not least reflected in respective educational efforts. Against this background it seems important to have a close look at the model of design and respective epistemic assumptions enacted in a specific context, before looking for commonalities that hold across settings in the first place.

While there is number of studies on various aspects of design studios in different domains (e.g. Lahti, Seitamaa-Hakkarainen, Hakkarainen, 2004; Maldonado et al., 2007; Vyas et al., 2009), only few studies explicitly aimed to elicit the epistemic frames enacted in these settings. Three noteworthy exceptions are the

ethnographic studies on design studios reported by Schön (1987), Shaffer (2003), and Sawyer (2012). In his analysis of design studios in architecture Schön (1987) has focused on the interactions between the student and the studio master and suggested these interactions to be essential to the development of a designerly way of thoughtful action centered around processes of framing, naming, moving, and evaluating. Shaffer (2003) followed students in an architectural design course at the MIT trying to elicit the structures underpinning the students' practices in the studio. To do so he depicted the way in which surface structures, pedagogy and the particular epistemology of the design process form a coherent system of activity. The epistemology he traces emphasizes the need for an individual interpretation of the design problem by the architect as well as the organization of the design process "around the development and articulation of expressive ideas" (p. 25). Finally, Sawyer (2012) carried out an ethnographic study at two professional schools of art and design aiming to identify general principles of the cultural model of the design studio. Synthesizing observation from interaction in the studio and interviews with instructors and students from a variety of domains, including among others interior design, illustration & architecture, he characterizes the teaching practices in the design studio as a form of "disciplined improvisation" (p. 34), in which the students are supposed to master a deliberate and effective design process. All three studies focus on how design is actually practiced within the design studio. However, both Schön and Sawyer, either implicitly or explicitly, assume that there is a common model of design. Only Shaffer's (2003) analysis fully accounts for the situatedness of the enacted epistemology, and therefore provides the most direct point of reference for the present study.

## Research Design

The study was carried out in a design studio setting at the Muthesius Academy of Fine Arts and Design in spring 2013. The Muthesius Academy, founded in Kiel in 1907, is devoted to the systematic study of art and design. The school has about 500 students and offer bachelor and master programs in the fields of Fine Arts, Industrial Design, Communication Design, Spatial Strategies and Art Education. The course we followed was part of the study program on Industrial Design with a specialization on Interface Design. It was run by a professor and a research assistant. Eleven bachelor students in the 5<sup>th</sup> semester and six master students took part in the course that lasted from April to July, spanning a period of 14 weeks. Under the overall theme "simulation/simulator" the students were asked to define and carry out individual design projects. All students enrolled in the course were included in the study.

Our orientation towards practices led to a combined use of different research methods including (a) observations of the interactions between the students and the teaching staff during the contact hours, (b) students' narrative accounts of their working process, either voiced in students' interactions with the teaching staff or in informal interviews carried out by the research team, and (c) the material arrangements and artifacts present and utilized in the design studio. Data was recorded in the form of extensive field notes supplemented by photos and audio-recordings when feasible. All in all, a total of three observers conducted over 64 hours of site observations, taking part in over 90 individual feedback sessions as well as the students' final presentations. In parallel, the observers wrote memos following the sessions they attended and conducted a workshop with the students and the professor aimed to elaborate on the utilization of design artifacts in the middle of the term. Each of the observers has at least two years of teaching experience in a design related domain. Informed consent to take part in this study was obtained from all participants including the teaching staff.

To identify commonalities within the setting but also to trace variability, each of the students' projects has been treated as a distinct case in the analysis. Field and interview notes were organized into chronological case logs. Using an abductive approach, case logs and memos were used to surface patterns of interactions, which were then iteratively tested against the other cases until a stable set of patterns was found. Afterwards, the patterns and supporting data were used to trace the underlying epistemic frame.

## Findings

In line with the analytic procedure, the presentation of findings starts with a general description of structural elements of the design studio. Against this background an overview of the actualized patterns of interaction is given and the underlying epistemic frame is reconstructed.

### Structural Elements of the Design Studio

As pointed out by Shaffer (2003), the setup and organization of a design studio is strikingly different from a lecture hall, seminar room or classroom. The students in the course were provided with a large open workspace that they were only sharing with students of another course in the study program on Industrial Design. Within this workspace the students were free to setup permanent working areas, an option made use of by six of the students. The other students used the room as a temporal working and meeting space, especially during plenary meetings as well as the feedback session with the teaching staff. In addition the students had access to a variety of workshops on campus, an option used by the students working on hardware related projects.

While plenary meetings and feedback sessions with the professor took place during two fixed timeslots on Tuesdays and Fridays each week, the research assistant also dropped in the workspace in between. Apart from this, the students were free to decide when to work on their projects, each of them having access to the shared workspace 24 hours a day. With a calculated workload of 23 working hours per week the design projects were supposed to make up for most of the study time. In parallel, the students had to attend an introductory course on Human-Computer Interaction also given by the professor.

The overall project assignment “simulation/simulator” was introduced to the students by the professor right in the beginning of the semester. Besides a general motivation the students were asked to address the theme from a designerly perspective either by building on existing projects in other disciplines or taking a more artistic stance towards the question of simulation and reality. In the first plenary meeting the professor invited the students to reflect on previous project experiences followed by a collective brainstorming and discussion of potentially relevant questions. In the two subsequent meetings the students were asked to present their personal working plans for the course, detailing the envisaged stages of their projects and time management, elaborate on potential design questions and give short presentations on a range of topics approaching the overall project theme from different perspectives. From then on the focus shifted towards the students’ individual projects only interrupted by a plenary session in the beginning of May in which the students were asked to reflect on their work process, as well as a plenary presentation of interim results asked for by two students in the end of May. Apart from these plenary sessions most of the contact time, about 7-8 hours a week, were spent on individual, sometimes also small group, feedback sessions. In these sessions, which took place in the students’ workspace, the students presented their work in progress and discussed problems, design options and future directions with the teaching staff. The feedback sessions were of varying length but usually lasted for about 20 to 40 minutes.

The projects ended in a plenary presentation of the project results, attended by the participants of the course and the teaching staff, as well as a public exhibition on the campus of the Muthesius Academy. Additionally projects had to be documented on an online platform provided by the academy.

## **Patterns of Interaction**

The analysis of the case logs resulted in the formulation of twelve patterns of interaction, which synthesize the observations throughout the 14 weeks of students’ project work. These patterns describe recurrent ways of how the students and teaching staff coped with and transformed the situations they were facing throughout the design process. They are supposed to provide middle-level abstractions in that they capture situationally bound regularities in a form potentially verifiable and intelligible to other practitioners (cf. Dearden & Finlay, 2006). Even though not every pattern was observed in each case, the set of patterns is assumed to be characteristic for this context in that each of the patterns was instantiated in at least 50% of the projects, often repeatedly. According to their spatio-temporal extension, the patterns have been grouped into three main clusters: (1) foundational patterns that provide a background and reference point for all other design activities but also locate students’ projects in broader realms of personal and professional development, (2) structuring patterns that render resources accessible and orchestrate project activities, and (3) patterns geared towards the advancement of project related ideas. The latter includes both prospecting patterns (3a) aimed at the exploration of ideas as well as anchoring patterns (3b) focused on the safeguarding and integration of ideas. In the following we briefly sketch the patterns of interaction along these clusters.

### **Foundational Patterns**

Foundational patterns of interaction include the explicit *framing and re-framing of the design space*, the *presentation of results to the outerworld* as well as the *working at the horizon of one’s own capabilities*. Being provided only with the generic theme “simulation/simulator” the students had not only to produce a product but also to advance a frame of reference that motivates their design by circumscribing the design space they want to operate in. While for example some of the students framed simulations as a means to learn certain concepts others conceptualized it as a tool to open up new perspectives or to provoke emotions and trigger thoughtful reflection. Successful framing and eventual re-framing provided the students with concepts and criteria to communicate, focus, and orient their design project. In taking a certain perspective the students also had to position themselves in relation to disciplinary questions as well as societal concerns. Similarly, by being asked to present their results to interested audiences, both during as well as at the end of the course, the expected quality and relevance of students’ projects, which were expected not only to foster personal learning but also to bring forth worthwhile concepts and products, became salient. Furthermore, by defining projects at the horizon of the students’ capabilities, students were asked to move beyond the already known and learned, and explore into emerging opportunities.

### **Structuring Patterns**

This cluster of patterns includes *agile project management*, *help seeking*, and *carving space*. In the course of their projects the students had to plan and manage their activities taking into account given constraints as well as

all kinds of uncertainties. While the participants apparently drew on a generic model of the design process including ideation, conception, design, prototyping, and presentation, the actual project management was highly agile in that the students adapted and revised their plans in light of the obstacles but also possibilities that opened up in the course of the semesters. The students did not only utilize given resources but actively sought to render new resources accessible. In particular, students were seeking help not only among fellow students and teaching staff but also among friends, relatives, external practitioners, and domain experts. In doing so the students not only resolved acute problems but also broadened their own scope of action and expanded or consolidated their social networks. In addition, students carved both individual and collective spaces in support of their projects rendering accessible both social as well as material resources.

### **Prospecting Patterns**

The prospecting patterns of interactions that are central to almost all projects include: *imaginative walkthroughs*, *making ideas tangible*, *playing with ideas* and *reflective prototyping*. What these patterns have in common is that they explore into the design space aiming at new insights regarding potential constraints or potentialities. Even though the patterns address somewhat different situations, they all entail a momentum of uncertainty and limited knowledge. In an imaginative walkthrough the actors simulated an anticipated usage scenario trying to develop an empathic understanding of the foreseen target population and their experiences. These walkthroughs helped to identify requirements but also to elicit potential implications of a certain design decision. While these walkthroughs had a strong narrative moment, students created and made use of tangible objects when trying to come to terms with experiential qualities and bodily experiences relevant to their projects. In playing with ideas, the participants typically started from a vague idea or incident, which was then explored in an open-ended, associative, and non-judgmental manner. In playing with ideas verbal comments were riddled with gestures and comments but also augmented with finds, artifacts, as well as ad hoc sketches. Finally, the students also developed prototypes to explore the feasibility as well as potential (side-)effects of design options.

### **Anchoring Patterns**

The anchoring patterns of interaction that complement the prospecting patterns comprise of the *focused lead-in and lead-out* as well as the *deliberate decision-making*. The focused lead-in and lead-out brackets the stream of events marking the start and end of the feedback sessions as well as all types of presentations. While the focused lead-in aimed to raise the dialogue partners' interest, provided required background information and set the agenda, the focused lead-out synthesized the outcomes of the session, including the steps to follow. Deliberate decision making, in contrast, was triggered whenever students realized that they were approaching a relevant bifurcation point. Rather than striving for a satisficing option only, students usually explored and elaborated on a set of design options before coming to a defensible decision.

### **Reconstruction of the Epistemic Frame**

While each of the patterns of interaction denotes an important transformation in the course of the students' design projects, the patterns do not exist in isolation but form a complex meshwork. For example, a successful *imaginative walkthrough* usually requires a *focused lead-in and lead-out* in which a certain *framing* is introduced or challenged. The question hence arises whether there is a common interpretative scheme i.e. an epistemic frame against which this meshwork of practice is enacted and can be understood. Following Stumpf and McDonnell (2001) we reconstruct the underlying epistemic frame along the model of the design task, the model of the design process, as well as the model of the designer implied in the meshwork of practice.

### **Model of the Design Task**

Despite the considerable differences in the ways students carried out their projects, ranging from highly experimental to concept driven approaches, a concern essential to all projects has been the development and conveyance of a sound and appropriate interactional experience. While the overall theme „simulation/simulator“ is open to a variety of interpretations the students were expected to develop a perspective through which they want to approach the design task. This was already made explicit in the initial meeting, when the professor explained that: „design is anything but arbitrary“. Throughout the course the professor urged the students to take a stance and make deliberate decisions based on their interpretation of the design task. Irrespective of the particular perspective the design space was however approached holistically. Functional, technical, experiential, aesthetical, and ethical issues were not treated separately but approached in a highly integrative fashion. For example, envisioned interaction metaphors for a mobile app were discussed not only in terms of their usability and visual appearance but also with regards to their meaning for a community of users. As a consequence, students and teaching staff were constantly cross checking for example how technical and aesthetical decisions would affect the experiential or ethical qualities of the designs. From an epistemic point of view the students were hence supposed not only to develop a concept or prototype, but an understanding of the creation of an interactive product and its qualities of use, based on a viable yet value-laden perspective.

Due to a strong focus on the envisaged qualities of use, in contrast to more technology-centered approaches, the elicitation and communication of the intended users experience were another major concern across projects. A student put his emphasis on the qualities of use this way: „My aim is not that the prototype works in the first place, but that the feeling it gives is a good one.“ Being aware that many phenomena relevant to the quality of a product are only insufficiently captured in abstract representations the professor warned a student: „But you cannot say, concept, concept, concept and then eventually comes the design ... this is exactly the tricky point.“ As a consequence prototypical realizations of the designs were often the only way to convey experiential qualities the students were interested in.

Furthermore, with its emphasis on the qualities of use of a specific product, the focus was on the particular rather than on the universal. Even though the professor repeatedly stated that design is not necessarily about innovation and the students are supposed to build on and integrate rather than invent technologies they were however expected to develop original and also novel solutions. However, originality and novelty in this conception are bound to the particular. Due to the specificities of their design concepts, existing know-how or expertise repeatedly rendered pointless, forcing the students to carry out practical experiments in order to deepen the understanding of given design options. In this sense the students were expected not only to work on the horizon of their own capabilities but also to add to the disciplinary knowledge base.

### Model of the Design Process

All in all the activities in the design studio at the Muthesius Academy were organized around the development of meaningful/fruitful options within reach. Even though the students did not have to develop a fully functioning product, they were expected to devise a design that at least in principle could be implemented with existing technologies and/or provide a working prototype conveying essential qualities of use. Towards this end the students continuously framed the design space, explored into and decided on design options they deemed most promising. While the initial framing of the design space marked an essential milestone for all projects, it was constantly reassessed and concretized in the course of the design process, sometimes resulting in a fundamental redirection of the overall project. With the emphasis on the development of sound solutions, in line with the student's interpretation of the design task, the students were neither asked to adopt a particular process model nor were they given a fixed set of design principles or methods. Procedures and criteria were rather suggested and agreed upon on a needs basis taking into account the particularities of the project at hand.

Despite the purported linear organization of the design process, chaining up phases of ideation, conception, design, (prototypical) realization, and presentation, the underlying epistemic processes of framing, exploration and deliberate decision making were highly iterative and agile in the sense that participants continuously reflected on the implications of the design moves made. Rather than drawing on a fixed set of requirements and constraints for an envisaged product, the participants sought and created situations allowing them to probe their ideas and provide new information and insights throughout all stages of the design process. Respective strategies such as *imaginative walkthroughs*, *making ideas tangible*, *playing with ideas* and *reflective prototyping* all typify forms of non-monotonic reasoning and hence expand the knowledge base, the participants can draw upon. Or as the professor put it with regard to prototyping: „It is particularly important, that there is something that you can figure out.“ In the same way the design artifacts created by students were used as catalysts for further elaborations rather than as mere explications of preexisting ideas.

### Model of the Designer

In taking a certain perspective on the design task and devising a solution, that is publicly exhibited, the students were not only expected to demonstrate their competencies and skills but also to position themselves in relation to disciplinary questions as well as societal concerns. The students were also expected not to stay with the already known and learned but to grow with their projects and produce meaningful results. The designer in this setting was characterized as a capable creator and decision maker who is able to cope with uncertain, complex and value-laden situations. At the same time, the designer was also expected to be aware of the limits of his own knowledge and skills. This dual demand was also apparent in the professor's behavior. He, at various occasions, articulated the limits of his own know-how while also expressing personal preferences and convictions.

Even though the outcomes of the design process were largely unpredictable, the designers were supposed to actively seek and explore the opportunities that are opening up. In doing so, they recurrently had to share preliminary and half-baked ideas as well as to put their models, mock-ups, and prototypes to test. While entailing the risk of failure, disappointment or misunderstanding this was seen as an important move, or as a student put it: „The more feedback you get, the more impressions you get.“ Additionally, a general curiosity and openness towards novel things and ideas seems to be required. In an interview a student explained: „In the end it's the job of the designer to deal with superficial knowledge. As a designer you might be provided with a short briefing and then you have to work with it [...] therefore its good that we are introduced to so many different subject matters.“ Furthermore, asking for assistance and help was not only seen as legitimate but actively promoted by the teaching staff.

## Discussion

Our findings fit quite well the overall characterization of the design studio as “a vital complex of material representation, social collaboration, creativity, emotionality and a tolerance for uncertainty if not outright confusion – balanced with a faith that meaningful designs eventually will emerge” Wang (2010, p. 176). On a general level the outcomes of our analysis also appear to be compatible with findings of Schön (1987), Shaffer (2003), and Sawyer (2012) in that (a) design is aimed at unique and open-ended problems, which have to be framed by the designer, (b) design is an iterative process in which a series of intermediate design products is created and reflected upon, (c) that this process is mediated by generative feedback and social scaffolds, and (d) that design is best taught in the process of designing itself.

However, when having a closer look at our findings there also appear some noteworthy differences in the way the design studio is enacted in the course we followed. First, in comparison to the other studies, the design assignment in the design studio at the Muthesius Academy was much more open, inviting students to build on existing projects in various disciplines or to take a more artistic stance towards the question of simulation and reality. Hence, the students had to start from their own themes and ideas and argue for their relevance. Second, the professor neither provided the students with a consecutive series of assignments, as reported by Shaffer (2003), nor did he advocate any particular process model, as suggested by (Sawyer, 2012). Even though the participants occasionally referred to a generic model of the design process, the actual approaches differed significantly and were highly agile. The design approach enacted by the students, significantly differed from the analysis-synthesis model referred to by Sawyer (2012), in that the students actively sought and created situations to generate new information and insights. Third, while the creation of tangible products was also a major concern in the studios observed by Schön (1987), Shaffer (2003), and Sawyer (2012), we found a strong emphasis on the experiential qualities than their formal or representational properties. To test and convey their ideas the students in our case had to create first hand experiences rather than representations of the intended products. In that sense they not only had to express their ideas but also to create an (experiential) proof of concept. Finally, the focus in the design studio we followed has not only been on the mastery of disciplinary skills but also on the cultivation of personal design identities as well as the advancement of the disciplinary knowledge base. In fact, the disciplinary boundaries of the design studio were rather open, which also reflect the interdisciplinary roots of the field of Interface Design.

The case study design does not allow for generalizations to other contexts and the reported deviations might at least partly be attributed to disciplinary differences or personal attitudes and preferences of the teaching staff. Additionally, as epistemic frames are ephemeral in nature they are not open to direct observation but must be inferred. However, despite these limitations the results challenge the assumption that the design studio builds on a uniform pedagogy and entails a particular epistemology. The findings rather indicate that we should expect substantial differences in the way the design task, the design process, and the designer are understood by those involved in respective practices.

## Summary

The study traced the creative practices enacted in a design studio in the field of Interface Design throughout a semester. In the analysis the design studio was portrayed as a well-attuned system of structural elements, patterns of interaction and epistemic assumptions. The comparison of our findings with other ethnographic studies on educational design studios revealed some basic similarities, but also a range of significant differences. We argue that these differences are not incidental but back up the assumption that there are significant differences in the epistemic frames enacted by practicing designers as well as in design education. The respective assumptions about worthwhile forms of knowledge, forms of knowing, and the means to advance the collective knowledge base, have direct implications for the understanding of creative practice as well as what it means to become a creative actor.

The perspective taken in this study also raises to question the idea of a uniform design mode of thinking constitutive for all kinds of creative knowledge work as suggested for example by Bereiter (2010). Instead of striving for generic principles on how to foster creativity (e.g. Sawyer, 2012) we believe it to be more fruitful to continue the detailed analysis on how creativity is practiced in different domains and settings and shed light on the mechanisms through which respective practices are nurtured and cultivated.

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