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A stage-based model of design teaching

Abstract

With a focus on the teaching of design students in higher education, the article will present a teaching approach model that follows the stages of the design process. The model suggests that at the Definition stage, the supervisor can focus on leading the student into a more thorough elaboration of the design problem; at the Analysis stage, the supervisor can facilitate a controlled structure of what needs to be investigated by taking on the role of a caring guide; at the Creating stage the supervisor can ask questions that reveal alternative angles; and at the Form Making stage the supervisor can apply an approach inspired by the master–apprentice relationship, where the student learns by observing the master at work.

Key words: *design process; design activity; design education; typography; type design; graphic design*

Introduction

Teaching in higher education involves a number of different formats including lectures, mid-term critique, final critique, group supervision and individual supervision, all of which have interesting aspects to consider when facilitating maximum learning. The emphasis of this article is the educational approach of one-on-one supervision in design education. The article will only scratch the surface of the many sub-categories that constitute the design process, focusing on how to vary the dialogue following the stages of the process. The idea is to create a support system that will motivate the student to develop a thorough design process that will fit the individual student's way of working. This model of teaching should, consequently, not necessarily be apparent to the student but should, figuratively speaking, function as an invisible crutch that can be removed once the student has learned to stand on his or her own feet without support.

The hypothesis is that by applying different teaching methods matched to the individual requirements of the stages in a typical design process (Specification, Analysis, Creating and Form Making), the proposed stage-based model of design teaching will facilitate better student learning and further provide the supervisor with usable tools in his or her communication with the student. The article will report initial findings based on a pilot case study, which indicates that the hypothesis might be true.

In the influential publication *Taxonomy of Educational Objectives*, Benjamin Bloom et al. (1956) identified three domains of educational activities, 'cognitive', 'affective' and 'psychomotor', all with a number of subcategories. The first category revolves around matters of comprehension and critical thinking, while the second category revolves around emotions and feelings, and the last category revolves around the physical skills of mastering the tool. The purpose of this categorization was to identify a system that could support educators in

the development of curricula and the evaluation of students' work through a structure that would cover all essential learning approaches. A natural follow-up on this idea would be to apply different teaching strategies depending on the nature of the educational activity at hand. Several educational researchers have focused on the different communication approaches that teachers can adopt in the student dialogue. Petersson and Vahlne (cited in Lauvås and Handal 2010: 172) present five supervisory methods aimed mostly at group sessions. The methods originate in specific situations, such as what to do when the student shows signs of resignation or how to support groups of talkative and inspired students. The suggested methods can easily be implemented in the practice of group teaching and have the collective aim of generating a reflective process in the student.

While discussing the position of a personal tutor, Wheeler and Birtle (1993) found that teachers tend to play different roles in the student–tutor dialogue. These range from the role of a friend over a stricter disciplinary role to a more academically orientated role. The roles may vary, depending on the situation, and sometimes they even overlap. The authors argue the importance of the teacher maintaining a sensibility towards which role to play in a given situation. Although the nature of the tasks varies between that of the personal tutor, whose main responsibility is the student's welfare, and that of the design supervisor, whose main responsibility is to facilitate a learning process, the common ground is that different situations demand different tactics from the tutor/supervisor. Lauvås and Handal (2010: 173) emphasize that the supervisory dialogue should never become a standardized repetitive procedure, as a skilled supervisor should be capable of adjusting his or her approach depending on the situation. The researchers further highlight the great need for a method of varying approaches and point out that this is especially important in relation to creative work, where the supervision too often tends to be focused on analysis and problem-solving, with not enough focus on expansive thinking and untraditional solution attempts.

Based on the term 'direction of fit' as employed by John Searle (2005), the process of designing has been explained by Ann Heylighen et al. (2009) as consisting of a number of stages between which the designer moves back and forth with a world-to-mind (imagination) and a mind-to-world (evaluation) direction of fit. The notion is that a given artefact being designed must match the designer's idea about the world. However, in the design process, other matters may influence the work and thus reshape the designer's idea, based on the nature of the world. This change of direction has its purpose. A project that is based solely on the designer's imagination of the world risks being irrelevant to anyone else; on the other hand, a project that is based solely on an evaluation of the world risks failing to contribute anything new. Consequently, the different stages of the design process will benefit from variation in the direction of fit.

Numerous researchers have analysed the design process with various foci (for early examples, see T.J. Howard et al. 2008); recent studies include Jaap Daalhuizen et al. (2014) investigating design students' approaches to problem solving through different methods, Tilanka Chandrasekera et al. (2013) investigating the 'aha' moment, and Philip Cash et al. (2012) investigating the small-scale design experiment. Although designers' approaches to designing can vary considerably, there would appear to be a general agreement among design methodologists that the design process is structured in a number of stages, which involve different kinds of working strategies, and that it is possible to determine some form of model for this process. Such an example is presented by Paul J. Nini (2006), who operates with a series of subcategories with two distinct phases. The first of these phases relates to the investigation of the design problem and the development of a strategy that can address this,

while the second concerns the development of the concept and the refinement of the prototypes and solution. In the same publication, Matt Cooke (2006) divides the design process into four main stages, with the first stage concerning the definition of the problem (definition), the second concerning background research (divergence), the third concerning the creative development of the idea (transformation), and the final stage concerning the implementation of the design (convergence). After discussing several takes on the design process, Bryan Lawson ([1980] 2005: 48–49) proposes a model wherein the problem and solution emerge together between the stages of 'analysis', 'synthesis' and 'evaluation' with no chronological order of appearance, as he argues that jumping back and forth is essential for fully understanding the findings of each stage. Partly inspired by these descriptions, the present article divides the typical design process into the stages of Specification, Analysis, Creating and Form Making (Figure 1). It could be argued that the stages of Creating and Form Making should be one, as creative ideas are often developed through form making. Here, however, the two stages are separated, as the proposed teaching strategies are very different.

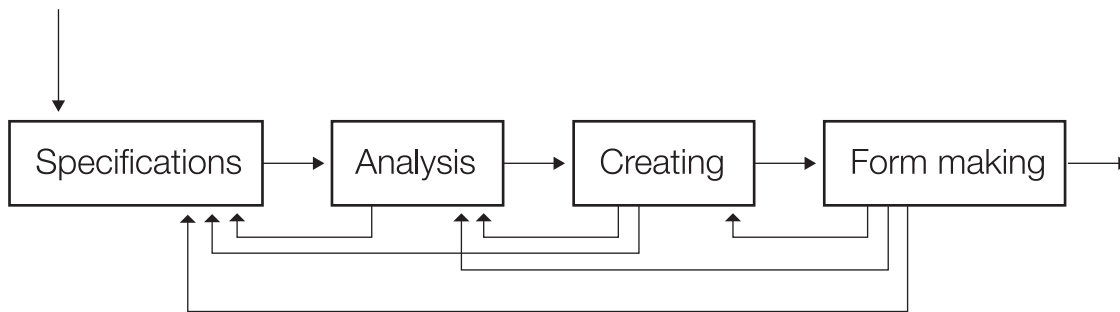


Figure 1: The design process. As more is learned about the project, all stages can enter a return loop to previous stages.

1. Stage one: Specification

The first stage is about outlining the project at hand. In real-life design situations, this is where the professional designer works towards understanding the requirements of the client and defines possible strategies for reaching the intended result. The designer focuses on identifying any possible approaches to the problem, which originate from the designer's own experience and understanding of the topic. In education, the specification of the project may partly be identified in the brief provided by the supervisor. That said, most good project briefs are framed to enable the student to decide his or her take on the case, and thus develop a feeling of ownership and excitement about the work that lies ahead.

1.1. Student Learning

According to Prosser and Trigwell (2001), students approach learning in two qualitatively different ways, one being a deep approach where the student aims at understanding the nature of the problem and strives to understand the assignment, the other being a surface approach where the student views the task as an external imposition and hence seeks to meet the demands with minimum effort. Extensive research has demonstrated that the student who applies a deep learning approach is more likely to understand the content of the text read (Prosser and Trigwell 2001: 15), which indicates that the deep approach facilitates a more productive learning culture. Prosser and Trigwell further find that the student's

perception of the learning environment and his or her chosen approach to learning are interconnected, in such a way that those students who find that the assignment provides clear goals while still leaving room for individual choices tend to apply the deep approach to learning.

1.2. The Educational Approach of Directing

To facilitate the desired learning environment, the supervisor's finest role is to be open towards any direction the student might explore and thus show trust in the students' capability to bring the project into an area of his or her own interest. In situations where the supervisor finds the student's chosen direction problematic, the supervisor can benefit from a technique described by Lauvås and Handal (2010: 271). The idea is that as the supervision takes its starting point in the angle that occupies the student's mind – in this case the problematic take on the brief – the supervisor will be attentive in the actual conversation while simultaneously working with a second attention level that constantly checks up on whether the session is moving in the direction intended by the supervisor. If that is found not to be the case, the supervisor can move on to locate key points in the conversation that leave room for changing tack. Through this process, the supervisor can guide the student onto a more fruitful path while ensuring that the student never loses his or her feeling of ownership of the project at hand. The supervisor operates with a mental map of the conversation that stretches beyond the topic of the dialogue.

2. Stage two: Analysis

At this stage the designer will need to bring his or her understanding of the project into the actual world. To do so, the student will profit from gathering relevant data to inform the project. This mind-to-world direction of fit allows the student to develop a better understanding of how the project should fit into the world. When successful, the stage will serve as a mental organization tool that can help specify the nature of the task.

2.1. Audience Research

Relevant information can be gained through obvious channels such as literature and online searches. In addition to this, the student can benefit from applying more systematic test methods. Paul J. Nini (2006) operates with three main methods for audience research. The first is survey research, which includes questionnaires and interviews. The purpose of this type of method is to gather information on participants' impression on a given aspect. The second is behavioural research, which involves observations of similar design artefacts in use. The purpose here is to gain a better understanding of user action and involvement with the design. The third is participatory research, which involves direct user participation in the development process. A fourth method of testing users' performance in early sketches of the design can be added to this: in the field of graphic design, this could be a measure of the time a user spends locating a specific target on a website; the number of successful identifications of non-words in a text; and the time spent reaching a target point in a wayfinding system, all examples that can be objectively measured in a good test study (Beier 2012).

2.2. Making use of the Collected Material

In a controlled experiment, Nigel Cross et al. (1994) studied the way design students gather relevant information for a given design brief. The findings demonstrated that the most successful students were those who vary their attention rapidly between gathering of small amounts of information and considering its relevance. These students were capable of quickly processing the new information and then immediately reflecting on its role in relation to the project. They were able to move forward in their design process without having covered all the possible aspects of the problem. As in any real-life design situation, it was not always clear what information was relevant to the project and what was not, which left the student with many open-ended questions. This the authors define as the inherent uncertainty of the design process. Cynthia J. Atman et al. (2005) have provided similar results in the study of freshman and senior engineering design students and demonstrated that senior students collected more information, considered more alternative solutions, had a higher number of transitions between different stages, and spent more time on the later stages than did freshman students. Bryan Lawson (1979) investigated different approaches to problem solving amongst final year architecture and science students. He presented participants with a task that had a hidden set of rules. The assignment was not to discover the rules but to perform the task correctly. The researcher found that among the fifth year student group, the scientists' approach was first to try to determine the rules and then to present their solution to the task, while the architects' approach was first to go through sequences of possible solutions and then to identify the solution they judged to be right. The scientists had a 'problem focusing strategy' while the architects had a 'solution focusing strategy'. Lawson found evidence that these differences in strategies were the result of the different educational methods, as the students at lower levels did not show the same difference in approach.

2.3. The Educational Approach of Guidance

The studies mentioned in the previous section suggest that a successful designer is capable of reflecting on small amounts of material without ever possessing all relevant information. For a novice designer, working in such an environment of constant uncertainty can be rather stressful. The supervisor's role is to support the student in setting up a clear aim for what information needs to be gathered. The supervisor can further work towards facilitating a constant reflection on what is discovered by making the student evaluate his or her findings on a regular basis. Furthermore, it will help the student overcome the vast amount of information that needs to be collected if the supervisor and student together set up subsidiary goals for what should be done before the next session.

3. Stage three: Creating

Given the information of the previous stages, the direction of fit here will have a more inward orientation, as the student focuses on his or her own imagination and perceptions of how things could and should be. This stage of designing is about developing the concept of the project. At this point, the design process is heavily influenced by explorations and idea generation.

3.1. Methods of Creative Thinking

Raymond Nickerson has emphasized that although 'knowledge of a domain' does not automatically lead to creativity, knowledge about the topic does appear to be relatively

essential for creative work, as he points out that 'good fortune will be useful only to one who knows enough to recognize it for what it is' (1999: 409). Following this line of thought, to ensure a successful creative stage, it is essential to gather sufficient information at the previous stages.

The desired creative breakthrough is often characterized as the occurrence of a significant event, the so-called 'creative leap' (Dorst and Cross 2001), where all the pieces of the puzzle seemingly fall into place. A large number of publications exist that propose different techniques for creative thinking. These include various techniques of maximizing ideation, facilitating divergent thinking, and different methods of reframing the problem. K. W. Lau et al. (2009) have described some of these techniques. In the handling of divergent thinking, the idea is that the student seeks a constant change of views while tackling a given problem, and the larger the range of perspectives the student considers, the better his or her understanding of the problem at hand. Another method mentioned by Lau and others motivates the student to work with associative thinking. This approach is based on asking the 'what if' question or making use of an exercise of replacing something with the opposite value or idea to see whether that might be worth looking at instead. The common purpose of these methods is to help the student gain a broader focus by facilitating ways of identifying alternative directions in the search for new concepts.

Conceptual blending, presented by Fauconnier and Turner (2002, 2003), is the idea of applying a mental operation of partially blending two different matters. By drawing selectively from elements from both, the operation creates a mental space that may facilitate the production of a more novel outcome. The fashion industry tends to make great use of this type of approach in assigning themes and storylines to collections. One example is the London-based fashion designer Makin Jan Ma, who finds inspiration in developing new characters for a fictitious film project and then creates collections based on these characters' emotions and experiences. Another example is the Copenhagen-based fashion label Moon Spoon Saloon, which is inspired by mixing elements from art, performance and fashion.

It is evident that not all client-based design briefs leave room for 'conceptual blending', yet in the learning environment, such an approach can support the student in developing methods of creative thinking and free association, which can later be successfully transferred to assignments with more restricted boundaries.

3.2. Sketching

Like the analysis process, the creative process is influenced by uncertainty and lack of control. According to Ashley Hall (2011: 21), this is in fact beneficial as it facilitates different kinds of coping strategies that may lead to new innovative directions and insights. A central tool in such a strategy is the use of sketching. As pointed out by Nigel Cross (2007: 54), sketching allows the designer to handle different levels of abstraction simultaneously, thus motivating problem structuring through a visual search for different solutions.

Sketching further plays a central role in avoiding the pitfalls of the limited size of the working memory. In a study of the quality of the design activity when professional architects were either blindfolded or allowed to use sketching, Bilda and Gero (2007) found that when blindfolded, participants' cognitive and perceptual activity dropped after approximately twenty minutes of work. The findings thus indicated that the absence of sketching results in a mental overload that reflects negatively on the quality of the work.

Sketching further supports the communication between student and supervisor by providing insight into the student's mode of thinking and visualizing the ideas that the student has explored. It further enables the supervisor to identify and point out any areas that

would benefit from further experimentation. To motivate the student to incorporate sketching as part of the process, the supervisor can integrate small exercises where the student practices different sketching techniques and visualization methods. Each of these exercises may have a duration of one to five minutes, which should provide enough time for the student to visualize his or her immediate thoughts but not enough for the student to go into detail with the drawings.

3.3. The Educational Approach of Open-Ended Questions

The stage of creating can be frightening, as there is never any guarantee that a creative solution will occur. The role of the supervisor is to guide the student through various cognitive exercises to facilitate creative thinking and thus provide the student with a method for producing solutions. At this point, the supervisor and student are working in a collaboration where each is assigned different responsibilities: the supervisor is responsible for ensuring that all relevant options and directions are explored, while the student is responsible for producing excellent ideas. In this sense, the two are working as equals with the aim of identifying an acceptable solution. The educational approach is to ask lots of open-ended questions without judgement. The nature of the dialogue is what Per Linell (1998: 163) calls a 'symmetrical dialogue', where both parties carry the discourse of the conversation by taking turns to introduce new content for the other to respond to. The primary role of the supervisor is to facilitate the student's ideation. However, if the supervisor becomes too involved in the generation of ideas, the student will lose confidence in being able to carry out an assignment without support. This is obviously problematic, as a central aim of any teaching session is to enable the student eventually to stand on his or her own feet.

Milene Gonçalves et al. (2014) investigated the nature of inspirational sources that designers apply in idea generation and found that students tend to limit the number of methods for inspiration, compared to professional designers. While the students often restrict themselves to the use of brainstorming as the sole method, professional designers often also apply other methods, including function analysis (making an extensive list of the individual parts of the problem) and scenarios (a description of an authentic situation with the user in focus). The researchers argued that in light of the potential freedom of the educational environment, students ought to take a more explorative approach to inspirational methods. Following this, the supervisor may work towards facilitating a broader foundation for insight by motivating the student to apply different idea-generating methods than he or she initially feels is needed.

4. Stage four: Form Making

At the form-making stage of the process, the designer's main focus is the visual manifestation of the project. How does it look and feel? Do the different elements of the project fit together as intended, or is there another way to present the concept?

4.1. Psychomotor Learning

Excelling at a craft within any field of design will most often involve some form of psychomotor learning; in other words, to master the skill the student will need to fine-tune the relationship between a cognitive function and the physical movement. In this regard, some of the ideas on motor skills in sports may be relevant. According to Robert Kerr (1982), one of the most central factors in motor learning is the 'knowledge of results'. This knowledge is

acquired in connection with the performance of the task, as either intrinsic or extrinsic feedback. The intrinsic feedback is a direct consequence of carrying out a movement; it involves all the information we receive from our senses as we move. In relation to form making, this might be the feeling of the hand when drawing on the paper and the eye's communication with the hand while directing the course of the stroke. The extrinsic feedback is artificially added and not a direct consequence of the performance. This type of feedback is related to the actual outcome. The feedback may be provided by others, such as a response to whether the student has managed to refine the drawing to such a degree that others interpret it as intended. However, to create a drawing that will succeed in its communicative intent, the student has to understand the stages of getting there. It is consequently essential not only to be given the knowledge of result but also to be given the 'knowledge of performance'. According to Kerr (1982: 78), in the sport of diving, where the performer is required to produce certain movements while swimming, the time score of the swim (knowledge of results) does not help much in understanding how to improve the specific movement; in this case, a video replay of the dive will be more helpful (knowledge of performance).

Providing design students with knowledge of their form-making performance will help guide them in their practice of attaining the skill.

4.2. The Educational Approach of Apprentices–Master Relationship

Following the ideas from the field of sports, the optimal feedback on performance should be exact. The open-ended questions applied at previous stages are less helpful here, as the goal is to guide the student the way a master instructs his or her apprentice. This leads to the theory termed 'legitimate peripheral participation' by Lave and Wenger (1991). Reporting from apprenticeships in a number of different trades such as tailor, midwife and butcher, the researchers concluded that in the actual learning situation, very little observable teaching was taking place. The apprentice simply learns by observing the master perform the craft. Through this process, the skills of the apprentice gradually improve, and following this development, the master offers the apprentice more and more responsibilities within the business.

A central premise of university teaching is its removal from the professional community of the practice; the environment therefore does not provide a natural situated learning set-up, where the student can engage in peripheral participation. The challenge of the supervisor is to create an illusion of a professional environment, enacting the role of the master at work by demonstrating various workflows and techniques of drawing and material processing. The presentation can be accompanied by verbal explanation, although not necessarily, as it is the student's observation of the action that is in focus.

The biggest shift in the didactic approach throughout the teaching of a typical design process is found between the Creating and Form Making stages. The main source of the difference lies in the supervisor–student relationship. At the Creating stage the student–supervisor relationship is almost collegial. At the Form Making stage, however, a new hierarchy takes over: the student and supervisor are no longer equals, because the supervisor is now acting as the master who always knows best. Per Linell (1998: 258) would describe this as a shift between 'relative symmetry' at the Creating stage and 'relative asymmetry' at the Form Making stage. If the shift in relationship is not carried out with great care, it risks generating frustration and confusion, as the student will be unaware of the changes. The situation will benefit from the supervisor informing the student of the shift.

By recognizing the functions of the master–apprentice relationship in modern design

education and by combining this with an open process of creative development and exploration, we can provide students with the tools necessary to become creative thinkers with a solid foundation in the craft.

5. Pilot Case Study on Typeface Personality

The proposed method of teaching was explored in a five-week module as part of the M.A. in Visual Communication at the Royal Danish Academy of Fine Arts. Twelve students attended the course with two supervisors (the author of this article acted as the main supervisor). The aim of the module was to develop the students' understanding of the semantic effects of typefaces and to explore their ability to create new and unexpected typeface designs.

The brief given to the students was to design a typeface for their mother. The suggested direction was to draw inspiration from her physical appearance, her personality traits, her handwriting, and the student's own relationship with her.

5.1. Procedure

To explore the effect of the stage-based model of design teaching, the methodology applied has a dual perspective, as it reports the experiences of both the main supervisor (the author) and the students. To ensure an accurate description of the events, the author noted relevant observations in a journal after each teaching session. To account for the student experience, the author carried out a number of qualitative interviews with five of the students after the end of the course. As mentioned earlier, the stage-based model of design teaching is not intended to be apparent to the student, and consequently all questions were focused on the student's experience of personal development doing the course.

Before initiating the interviews, the students, who had volunteered for the project, were told that the interview was related to a paper discussing the 'mother-project', which they should aim to be as truthful as possible, as critical feedback would not be a problem, and that audio recordings would be made. Each student was interviewed individually for about 30–45 minutes. The interviews were later transcribed for analysis.

Examples of questions
Did you learn anything from your analysis? Describe how you experienced shifting from analysis to concept. Describe how you experienced shifting between concept and form making. Did you apply different working strategies throughout your process? How would you normally have approached an assignment such as this? Do you often experience frustration while designing? Did the typeface end up as you anticipated?

Table 1: Examples of questions given to the students after completing the project.

5.2. Results and Perspectives

The following account of the pilot case study will proceed along the same stages of the design process as employed above¹.

¹ The students' quotations have all been translated into English by the author.

5.2.1. Specification

The idea behind the somewhat unusual combination of mother and type design is to prompt an alternative creative exploration and to encourage the students to rethink their expectations of what type design is, and what it could be. This approach was chosen because the students' relationship to the 'mother' figure may be complicated on many levels, since, due to their age, they are still in the process of developing a grown-up relationship with her. By having the students work almost therapeutically with the assignment, the aim was to enable a work process that would bring the students out of their comfort zone and hopefully add a touch of the unexpected to the situation. When asked how they initially felt when they were given the assignment, all the interviewed students expressed that they experienced a level of intimidation due to the personal aspect of the project. One student said, 'When you're at school, you like to be able to maintain a distance to things, and that wasn't possible here'. This feeling of potentially exposing oneself was shared by others, and another student elaborated, 'At first, I became somewhat defensive; I was afraid that someone might have problems with the assignment, but no one really did, eventually, it was like the spirit of the whole group changed, and we were all saying "let's do this"'. The assignment reflects the ideas presented by K. W. Lau et al. (2009) in motivating alternative directions of thinking, and further follows the theory of Conceptual Blending, as presented by Fauconnier and Turner (2002, 2003), by facilitating a mental space of blending elements of one's mother with the visual language of type design.

Being able to define detailed specifications was a central first step in the project. It was evident to the author that the students who did not manage to set out a clear direction from the start spent an unnecessary amount of time at the initial stages exploring what turned out to be dead ends. The task of the author and the co-supervisor was to make the student specify the exact story that he or she wanted to communicate. The delicate balance in this case was to ask helpful questions about the mother's personality and life without overstepping any personal boundaries.

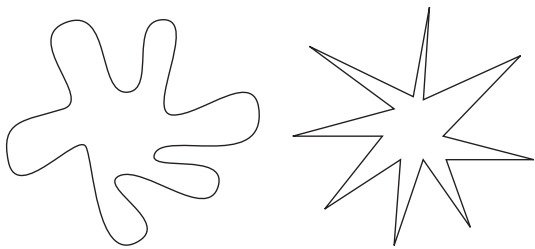


Figure 2: Research shows that when asked to assign the names Bouba and Kiki to a round shape and a pointy shape, most people will name the round shape Bouba and the pointy shape Kiki (Bremner et al. 2013; Maurer et al. 2006).

5.2.2. Analysis

For the analysis, the students were provided with links to relevant academic papers focusing on the semantic effects of typefaces through various forms of investigation (Barton et al. 2010; Brumberger 2003) and by focusing on the effect of the phenomenon identified as Bouba-Kiki (Bremner et al. 2013; Maurer et al. 2006) (Figure 2). Based on this theoretical foundation, the students were asked to conduct a questionnaire investigation with non-designers as participants. The task was to sketch a range of typefaces that expressed a list of adjectives describing their mother's personality and to develop a range of abstract shapes that

expressed the same adjectives; the typefaces and abstract shapes constituted separate parts of the questionnaire.

Not all of the students found this exercise equally fruitful; one stated, 'I thought it was superficial, also, I don't like the academic approach. You quickly realise that round shapes equals happy, and square shapes equals mad, you might get a bit further than that, but you won't get much more out of it'. Others were more positive:

I liked the notion of getting out and talking to people, because you tend to assume things when working with forms, and then you try to push the assignment in that direction. It's a good thing to be able to check up on the effect.

The different experiences appeared to be connected to the individual students' ability to create usable test material. It was evident that the students who managed to produce material that moved beyond the expected references to, say, 'round equals happy' were also those who produced findings that they could draw on later in their project.

5.2.3. Creating

Some of the students found it challenging to create a hierarchy of the information collected in the analysis. The task of the author and the co-supervisor was to motivate a continuous alternation between exploration and evaluation, and thus enable the student to identify the right number of different visual features in the final expression of the type. In the interviews, several students emphasized the positive role that the uncertainty of the task played in their creative process. When asked whether frustration should be a central part of a design process, one student replied, 'Yes, you need a sense of devastation to feel the sweetness of the victory, if you don't experience the frustration, the victory feels too easy. I needed the frustration to produce a typeface that was truly personal'.

The course module comprised a calligraphic workshop with exercises to explore how various calligraphic techniques and writing tools can express different adjectives and emotions for the reader. The supervisor observed that some of the students found it difficult to translate the calligraphy references into their project. By looking through the student calligraphic sketches, the supervisor could point out relevant details and writing styles that the students might have overlooked.

Many of the students preferred a method of sketching on the computer and therefore tended to disregard the calligraphic tool before fully exploring its potentials. It was clear to the author that this shift to the digital working tool early in the process was not beneficial. When motivated to go back to the hand-drawn sketches, the students' experiments became freer and more intuitive. When working on paper they were in control of the visualization; when working on the computer the software dictated too many decisions. Motivating the students to stay with the paper had an effect. In reflection, one of the students who had wanted to move quickly on to the computer stated, 'I'm more patient on paper than on the computer; on paper I am faster in coming up with ideas'. This confirms the findings of Stones and Cassidy (2010). In a controlled experiment, the researchers looked at how often students would reinterpret a drawing while sketching by hand or on the computer; they found that on the computer, the students were less likely to follow through on reinterpreting shapes that they had identified as qualifying for further exploration, while they did this more often when they were drawing by hand.

5.2.4. Form Making

Some students felt uncomfortable with drawing by hand and consequently applied a sketching method that was too rough for the purpose; in these situations, the author helped the student break down the barrier through a practical demonstration of different sketching techniques and by showing the level of detail in which the letter features can be drawn. The students were further asked to provide a printout of their typeface where the supervisor could indicate corrections by drawing on top of the designs. At this point, the author and co-supervisor were guiding the student back and forth between the stages of Creating and Form Making. This follows the phenomenon frequently referred to as 'co-evolution' (Dorst and Croos 2001; Poon and Maher 1997), which indicates that the problem is often not fully understood until some acceptable solution is produced, and, consequently, the problem and the solution emerge together. Hence, for a successful outcome, the project will often benefit from such a shift back and forth. One student found this difficult on some occasions: 'When moving on to form making, I tried to put my mother slightly aside, because if she was too present, she would constantly remind me that she is also so many other things than the angle I was working on'. In these situations, the author would support the student's need for isolating focus areas, while ensuring that he or she did not wander too far off the path.

To the question of whether the final product correlated with what the student had originally anticipated, several students replied that the outcome turned out to be very different. As one student put it, 'I had an idea in my mind, but the idea didn't match my mother's personality, it matched my own interest'. The student then elaborated on how the process helped him get on the right track. Another student found that 'the typeface that I wound up with is very different than what I initially had in mind. The final product has been strongly pushed in so many surprising directions'. When asked what brought this about the student replied:

I didn't feel 'safe' in the beginning of the project. The assignment distorted what I knew, and that made me feel insecure. By the end of the project, I knew and understood the boundaries, which made me confident enough to try out entirely new directions.

All of the interviewed students demonstrated a high level of reflection on the various events that helped move their project forward. They further demonstrated a good understanding of the difference between their own way of working and others' approaches to the task. This suggests that there is a beneficial side effect to the stage-based model of design teaching in developing the students' engagement in metacognition. By providing them with knowledge and understanding of how to learn more, the method equips the student with skills for managing their own cognitive abilities. Through this attention, the student learns to identify his or her own weaknesses and strengths and find ways to adjust his or her work process accordingly.

*exhausted
worn curious
compromise*

**madre
mum
mama**

**Glad farmor på
vej hjem fra
super Selmadag**

Figure 3: Examples of students' work by Andreas Christensen (top), Daniel Siim (middle) and Torsten Lindsø Andersen (bottom).

6. Reflective Practice

Being able to reflect on one's own practice while immersed in the process was a central interest for Donald Schön (1983, 1987), who saw it as an activity in which the designer has a 'reflective conversation with the situation' (1983: 76). While working, the practitioner will reflect on what he or she finds uncertain in the project. Instead of continuing in a less ideal direction, a 'reflection-in-action' will help locate what needs further investigation and, when necessary, result in a new and more productive direction for the project. Schön further emphasized that designing is a holistic skill, which one must grasp as a whole in order to grasp it at all (1987: 158). Consequently, the student cannot learn the skill of designing by first learning how to carry out smaller units of the activity and subsequently combining these into a whole design process. The individual elements interact and hence must be understood and learned together. This central point emphasizes the difficulties of the task of teaching the design process. As the supervisor varies the teaching approach in accordance with the stages of the design process, it is essential – for both student and supervisor – to maintain a holistic view of the process at all times.

To the question of whether they applied different working strategies at the various stages of the process, the majority of the five M.A. students interviewed replied that they did not.

This directly contradicts the observation of the author, who found that their methods varied significantly, mainly between the Analysis and Creating stages. One student, however, showed an awareness of this. When asked about the relationship between these two stages in his project, he replied:

For me, they merged together, I started sketching right away, also before I had done the analysis, and I also kept sketching all the way to the end of the project, as I wanted to confirm that I was on the right track. I felt that I couldn't see my mother in a typeface until I had created the shapes, so I needed to make initial sketches before knowing how to do the analysis.

This follows the findings of Dorst and Cross (2001: 434), who, based on an investigation of creativity in the design process of professional product designers, concluded that creative design is not about identifying the problem and then finding a suitable solution; it is about a constant repetition of the different stages of the process, jumping back and forth between the 'problem space' and the 'solution space' of the design. When something new is learned it will demand a step back in the process for further evaluation.

7. Conclusion

The pilot study confirmed the hypothesis in showing that applying different methods of teaching to the different stages of a typical design process facilitated better student learning. The proposed stage-based model of design teaching integrates the method of direction at the Specification stage, the method of guidance at the Analysis stage, the method of open-ended questions at the Creating stage, and the method of an apprentice–master relationship at the Form Making stage.

For a design student in early schooling, the typical design process will be rather time-consuming. For the more experienced designer, the model will be applied on an intuitive level as part of a dynamic work process. Successful designers will rarely structure their work process as a series of sequential stages, where one stage always follows the other with no looking back. However, by assigning various teaching approaches to the different stages of a typical design process, the pilot case study demonstrated that although the students did not experience their design process as being stage based, this teaching method led the students on new creative paths. Without this method, it was expected that the students would produce similar work to what was produced in earlier courses on type design where the method was not applied. In these earlier classes, the students generally produced typefaces that lay within an expected range of variations, drawing on personal preferences of style and inspiration from contemporary typefaces.

By maintaining a high degree of awareness of what separates the stages of the design process and by working with the different methods of teaching, the stage-based model resulted in a clearer definition of the teaching task for the author. Furthermore, the pilot case study suggests that the teaching model helps the student develop a good understanding of his or her own work and offers sufficient support for building up the confidence needed to succeed with an otherwise challenging assignment.

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