

Seven Colour Contrasts Materialised

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Abstract

This paper proposes to use new teaching methods and materials other than paint in the basic colour classes for design students. The methods have been developed in the artistic research project 'CMF meets Colour Theory'. The project uses Johannes Itten's Seven Colour Contrast as a framework and a Research-through-Design approach to examine how the implementation of various materials together with three-dimensional form and light can enrich the student's learning of classical colour theory. The starting point is the hypothesis that students' motivation for learning increases when the colour work becomes closer related to their field of study.

The paper starts by laying out the background for the project 'CMF meets Colour Theory' followed by brief introduction to CMF, Itten's contrasts and artistic research. Next follows a presentation of 'The Colour and Matter Links', an analysis tool, that has been developed in the project as well as a presentation of two types of experiments that has been used in the project. Both analysis and experiments are subsequently elaborated through a case. The paper concludes by evaluating the experiments of the project based on the framework of Itten's Seven Colour Contrasts as well as the didactic challenge of making relevant colour teaching for design students.

Keywords: *Colour, Material, Design Experiment, Design Education*

1. Introduction

This paper describes part of the artistic development project; "CMF meets colour theory", which examines how education in colour and material can be integrated at Design School Kolding. Today, colour and material are two separate subjects. An interdisciplinary colour course is taught on the second semester and a course on material science and material strategies are taught on the fifth semester for textile and industrial design students. The purpose of letting the two subjects overlap is partly to stimulate aesthetic choices in the material subjects, which otherwise primarily focus on the construction, properties and environmental aspects of materials. In connection to the colour course, the purpose is mainly to bring colour theory closer to the student's field of study.

The colour classes today are based on the theories and exercises developed at the Bauhaus School in the 1920s (Itten 1977, Albers 2013). The students' examinations of colours are carried out using gouache, hatchings with markers and printed digital work.

All work is as such executed on paper. Through this work the students learn about the basic principles of colour physics, colour perception and about the interaction of colours. Later in their studies most students will implement this colour work into practical design projects, where they have to include both three-dimensionality and combinations of various materials. By adding material to the colour course, the assumption is that the students' work is tied closer to their design practice and it becomes easier for the students to apply knowledge of colour in their continuing design career. This assumption is supported by previous artistic research on the teaching of colour at Design School Kolding (Mikkelsen 2018). This study shows that by adopting an exploratory approach much like that of a design process in the colour assignments, the students' engagement and learning increases.

CMF (Colour Material Finishing) or CMD (Colour Material Design) is a design field that has grown rapidly in the design industry during the last decade. The CMF designer develops colour and material strategies for a product and relates to both materials' attributes including production and life cycle as well as to the product's emotional value. CMF designers are represented in many multinational companies that develop digital products, automobiles, footwear etc (Becerra 2016). Linking colour and material is how ever of relevance to all designers that work with physical design and the aim of the project 'CMF meets Colour Theory' is to make this link tangible and present in the colour classes in design education.

The project uses Johannes Itten's seven colour contrast as a framework for the investigation. Each of the seven colour contrasts proposes a certain interaction between two colours. The same contrast can appear as both a high contrast and a low contrast. 1/ Contrast of Hue indicates the colours' difference in hue. The primary colours have the highest contrast in hue, where secondary and tertiary colours have lower contrasts in hue. 2/ Contrast of Value describes a light and dark contrast between two colours. The highest contrast of value is found when black and white oppose each other. 3/ In the Contrast of Cold and Warm, the colours relate to other memorised sensations. The highest cold-warm contrast is between blue-green the resembles ice and red-orange that resembles fire. 4/ The Complementary Contrast occurs when two colours are diametrically opposite each other in the colour wheel. When a pair of complementary colours are mixed the result is grey. 5/ The Simultaneous Contrast is a result from our vision trying to create a strong contrast. The simultaneous effect occurs when two colours affect each other and induces a visual contradiction with each other. 6/ The Contrast of Saturation or quality relates to the degree of purity of a colour. This contrast is found between pure, intense colours and dull, desaturated colours. 7/ Contrast of Extension represents the size ratio between two or more colour patches. Itten suggest harmonious proportions based on Goethes work on lightness. (Goethe 1971)

Design School Kolding is a design university with a knowledge production through both traditional research as well as artistic research. Artistic research is closely linked to design practice and uses the methods of the design profession. The research methodology 'Research through Design' also formulates an approach to research that adapts to design processes and design methods (Brandt et al. 2011, Koskinen et al. 2011). This paper refers to the project 'CMF meets Colour Theory' which is conducted as artistic research and as such it applies 'Research through Design' as a methodology. Design is characterised by an approach that is both explorative, intervening and problem-solving (Brown 2008, Lawson 2006). It is based on a user group's problem, which it aims to solve. In this project, emphasis has therefore been placed partly on the experimental work with the use of colour contrasts in material compositions and partly on interventions with the students who make up the user group. This has been programmed as an iterative process where the students have been active participants in testing methods and evaluating results.

2. The Colour and Matter Links

Since the project deals with colours embedded in a material, a 'Colour Sample' is here defined as a physical object that has both a colour and a matter. This makes the colour appearance dependent on the material properties. In order to clarify the mutual influence of the material and the colour on each other, the project presents a tool that the student and researcher can use to analyse the relationship between colour and material. The tool is inspired by David Katz's work on surface colours and how they present themselves (Katz 1935) as well as Erik Linnet's classification of various types of ceramic glazing and their colour qualities (Linnet 1996). The tool carries the title 'The Colour and Matter Links' and introduces four different types of relations. Each of the links indicates a specific relation between the colour and that part of the material property that is relevant for the visual perception of the colour. This leaves out certain tactile properties such as flexibility or softness as well as performative properties in the material. Each 'Colour and Matter Link' is presented as a continuum with two extremities in between which a specific colour sample can be placed. The four 'Colour and Matter Links' are:

1. Transparency: from opaque to transparent
2. Texture: from flat to relief
3. Finish: from matt to glossy
4. Uniformity: from monochrome to grained

The first 'Colour Matter Link'; 'Transparency' indicates the transparency of the material and thus the colour. With transparent materials, the colour and light of the background also begin to influence the overall perception of the colour sample. 'Texture' defines the colour sample's surface from smooth over a light structure to a rough relief. Here, the ultimate extremity would be a total, spatial form. 'Finish' is also about the material surface, but where texture indicates a three-dimensional structure, the finish is the surface skin from matt to glossy. 'Uniformity' indicates the colour's uniformity in the material from monochrome to grained. There is a difference in the colour appearance in a material that is dyed throughout compared to materials with irregularities in colours such as natural stone or a woven fabric with different coloured warp and weft. Here, the ultimate extremity would be a pattern.

By identifying a colour sample's placement on each of the four continuums the student can perform an analysis of the relations between colour and matter in the specific sample. The 'Colour and Matter Links' offer the student a tool and a language with which she can discuss the relationship between colour and material. This helps to create an awareness of the material's influence on the colour.

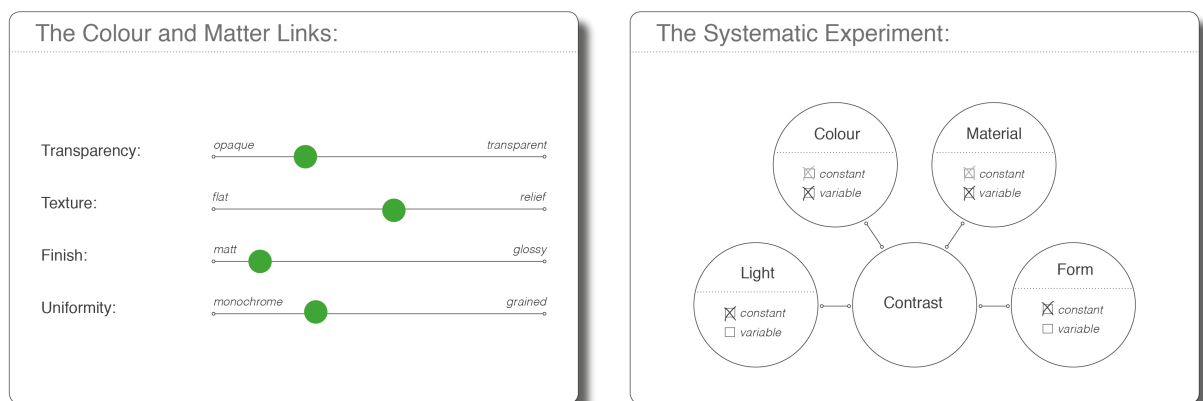


Figure 1 Work sheets for students.

3. Two Types of Experiments

The central content of the project is a series of experiments carried out by both students and researcher. The purpose of the experiments is partly to investigate how the material influences the selected contrast ratios and partly to get the student to connect colour theory with materials from her field of study. Thus; the experiments are correspondingly evaluated on two levels; partly on the basis of the framework which is Itten's seven colour contrasts using the analytic tool 'The Colour and Matter Link' and partly on the basis of the project's didactic challenge of making colour teaching relevant for design students. Common to the project's experiments is that they are based on a colour contrast and they are carried out with colour samples defined as a physical object that has both a colour and a matter. There are two types of design experiments in the project. They are referred to herein respectively as 'The Exploratory Experiment' and 'The Systematic Experiment'.

'The Exploratory Experiment' has the open structure of a design experiment and is driven by curiosity. It involves a particular designerly approach to the study that allows the student or researcher to act on unexpected outcomes (Cross 2006). It is less framed, more intuitive and can be started without a previous hypothesis of a potential outcome (Schön 1983). The Exploratory Experiment is initiated by the question 'what if..?'

'The Systematic Experiment' is easier to define as its structure is similar to that of the scientific experiment. It is performed under controlled conditions, with a limited number of variables and constants (Fagerstrøm 2017). Five parameters are set up as a framework for 'The Systematic Experiment'. These parameters can act either as a variable or constant and can change according to the student's or the researcher's wishes. The number of variables and constants can also vary according to the desired complexity of the experiment. The more variables the more difficult the experiment will be to evaluate. The Systematic Experiment aims to investigate the relationship between the five parameters, which are: 1/Contrast, 2/Colour, 3/Material, 4/Light, 5/Form. The Systematic Experiment is presented to the student as organised in the diagram in figure 1. The student will use the diagram to decide which variables and constants to work with.

4. Case: Experiment and Analysis

A textile student has performed a systematic experiment in which she examines the complementary contrast blue-orange. She produces colour samples as yarn wraps with different types of yarn in various shades of blue and orange. The yarn wraps thus becomes a constant form in the experiment. The lighting is also constant. Her variables are the colours and the materials respectively. At first sight, the yarn can also be seen as a constant, as it is not opposite other materials such as wood, paper, glass and more. But since the quality of the yarn fluctuates between metalized polyester, wool, silk and cotton with different surface treatments, it nevertheless appears as a variable material. Similarly, the colour changes so that both the blue and the orange colour appears in several variations of hue, saturation and value.

Among the groups of design students, this experiment was highlighted as one of the most systematic. However, as they had to carry out the evaluation of the experiment by recording the influence of the colour and the material on the complementary contrast, the complexity became apparent. A discussion arose as to whether it is possible to compare a complementary contrast that also varies in other contrast ratios. There are significant differences in value, as shown in figure 2, where both the orange and the blue colour are respectively very dark and very light. Also, there are large fluctuations in quality contrasts, since the saturation of the colour also changes from highly saturated to relatively subdued.

The conclusion was, that in order to assess the material's influence, the different materials had to appear in the exact same colour, which was not the case. However, there was broad consensus that 'The Colour and Matter Links' in the colour samples played a role in relation to the complementary contrast. The yarn wraps held differences in Finish and Uniformity. In relation to Finish, the shine of the mercerised cotton and metallised polyester is perceived as contributing to a strong complementary contrast. In relation to Uniformity, the unevenness of the wool yarn is experienced as a desaturating effect, partly because the yarn itself holds variations in the colour tones and partly because the yarn wraps was so open that the colour of the cardboard underneath became visible.

5. Statements of Material Influence on Colour

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1. Transparency: When a material has a high degree of transparency, it is affected by the colour and light of the background, which can cause changes in both hue, saturation and value.
2. Texture: A material with a rough structure may appear with a darker value due to the shadows in the structure. This can also make the colour sample seem less saturated.
3. Finish: A very glossy material becomes sensitive to light influences, which affects the value. A glossy material is experienced by several as contributing to a high saturation.
4. Uniformity: A material with a grained colour combination is perceived as less saturated.

These observations all point to the fact that the material has a great influence on our colour perception. The starting point for the project was to test Ittens Seven Colour Contrasts with other colour samples than painted goache. The conclusion must be that by adding different materials, the colour experience will be affected. For example, a quality contrast can be enhanced by the highly saturated colour having a smooth texture and a glossy finish, while the low saturated colour has a matt finish and a grained colour combination.

7. Conclusion

The project had two different objectives in its start-up. The first objective was to investigate how the material surface of an object affects our colour experience. The second and primary objective was to propose a teaching method that engages the students in the work of colour and material. Similarly, the project can be evaluated on the basis of the two different objectives.

A large number of both systematic and explorative experiments were carried out in the project. The results of the experiments were evaluated through comparison and discussion, which formed the basis for the above statements. The overall conclusion was that adding form, materiality and light has an enormous impact on the perception of colour. When the light hits a three-dimensional form, a number of colours will appear in the gradation between light and dark. When the light hits a material, the colours will be reflected differently depending on the material surface. These observations are supported by existing research on colour theory (Swirnoff 2003, Arnkil 2013).

By evaluating on the basis of the pedagogical and didactic objective, the project appears very successful. The project took its starting point in a hypothesis that the students would become more engaged in colour theory if the course could present a clearer link between colour theory and the student's field of study. Based partly on researcher's observation and partly on the students' online evaluation of the entire colour course, the conclusion is that the hypothesis has proved to be correct. The students were naturally curious about how to use materials from their own field of study to understand the colour contrasts. Especially the value contrast, complementary contrast, simultaneous contrast and saturation contrast was examined by the students and considered very useful in their continuing design work.

In addition to the two objectives the project has also given rise to reflection on methodology. It has been exciting for both researcher and student to work with the two types of experiments. However, there have been challenges associated with the evaluation of the exploratory experiment in particular. How can designers evaluate design experiments and qualitative work?

6. References

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