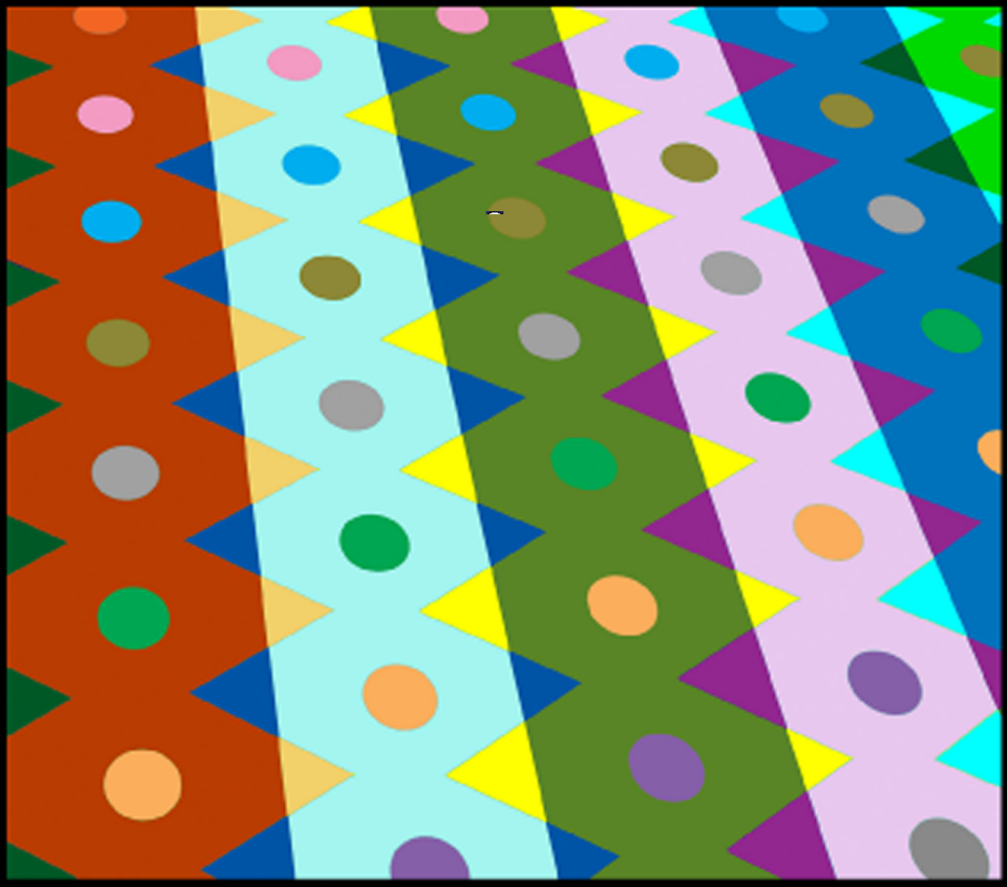
Beneath the Surface of Colours



Martti Huttunen

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For the Reader

We usually take for granted that the world around us is full of colours, but we focus our conscious attention to them only when they appear surprising or unusual. In everyday life, encountering colour phenomena and pondering the essence of colour may have brought to mind, for example, some of the following questions:

- What colours really are?
- Why the environment seems to alter colours?
- Were there colours before there were eyes?
- How do animals see colours?
- Why colour maps cannot always be trusted?
- What kind of colour was Acid green?
- Why colours on a computer screen and on print never seem to match?
- What is the essential difference between CMYK and RGB colours?
- Why does yellow turn greenish when it is darkened?
- What do metamerism and colour constancy mean?
- Is the blood of the aristocracy (the blue blood) really blue?
- Why do Christian bishops wear purple silk shirts?
- How do colours affect us, and where do colour symbols derive from?

This book will provide answers to the above and many other exciting questions about colours. At the same time, the reader has an opportunity to see and experience colours and colour phenomena in a new and interesting way *beneath the surface*.

In this book I will examine the rich world of colours from as many viewpoints as possible. I will also outline some theoretical models

that have been developed to understand colour phenomena. A qualified theory can remove the discrepancy between the theoretical and the observable and, thus, explain colour phenomena in an understandable way. This can benefit all colour education when both students and teachers can have a scientifically credible base to build their colour studies on.

For their encouraging support to my theoretical views, I would like to thank Professor Göte Nyman from the University of Helsinki Department of Psychology and art specialist Professor Antti Hassi. I would also like to thank my good friend Professor Paavo Castrén and my long-time associate Doctor Matti Jäntti for the many interesting discussions we have had and for verifying some of the facts in this book. I also thank warmly my close friends Päivikki Kumpulainen, Pertti Nummi and Harri Lahikainen for their assistance, and Jaap Hollenberg for his help in verifying the historical facts of colour use.

My thanks for expert help in aspects related to light and colour measurements go to Leif Riipinen and, for identifying certain rock types, to Geology Professor Martti Lehtinen. I would also like to thank the helpful staff of Suomen Gallup Ltd. for processing some of my research data.

My biggest thanks go to my sons Sampsa and Kaapo, and especially to my wife Marja. This book would not have been written without their criticism and encouraging support.

I dedicate this second edition of my book to my grandchildren Inari, Otto and Leo, and wish them a fruitful and colourful future.

Martti Huttunen

(First Finnish edition: WSOY 2005)

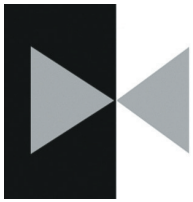
Why 'Beneath the Surface'?

It is easy to hold true something based on concrete evidence and reject beliefs based on unproven claims.

When ***Interaction in Color,*** a textbook by painter ***Josef Albers*** for teaching colour perception to painters, was published in 1963, it was welcomed enthusiastically by painters and other people interested in colours. Especially, from the point of view of colour education, the book provided a great deal of visually ambitious content. It contained beautiful colour tablets, and different types of exercises helped to illustrate, how the environment changed the appearance of colours. In his book, Albers drew conclusions about the relativity of colour and called the phenomena 'colour illusions'.

This can be seen, for example, in his comments about individual colours: ***"Why does colour deceive? Why does colour look different than it actually (physically) is?"***(Albers 1963, page 30). And to theses questions, he offered a multitude of answers. The visual examples in his book helped to bolster the false claim that we somehow see colours incorrectly. This false idea can be found in many books dealing with colours and colour vision – even in sources that should have, by now, excluded the claim as unscientific.

Although modern perceptual psychology has already for a long time held colours only as visual sensations, as interpretations of the human brain, there are still textbooks that use this classic example (see the pictures below.) to prove that we do not see colours accurately. Colour images in ***Josef Albers***' books have also been used as evidence for the unreliability of human visual perception.



When a pencil is placed on top of the circle, the grey halves of the circle no longer look alike. This example has been used to give us the impression that our visual perception is somehow unreliable.

Nevertheless, when encountering this sort of evidence, the reader should stop and ask further questions: Which grey side of the figure do we see inaccurately? The one with a darker or lighter background? And if the side with a darker background (the one in 'shade') appears inaccurate, is it because we have been taught to think that a white background does not affect the appearance of colours at all?

What these kinds of examples have been used to prove as illusory, actually shows, how accurate and advanced the human visual perception is. It also gives us an example of a phenomenon that I call shadow effect, which is one of the fundamental principles of our colour vision. In this book, these examples will be used to explain a variety of colour phenomena.

Harsh living conditions have always eliminated nonviable individuals. Natural selection has also guided the evolution of vision: An individual with a distorted colour vision would hardly have survived and passed on his/her genes to future generations. For this reason, the human visual perception and colour vision can be regarded very advanced and functional.

Throughout the years, various theories and opinions have been used to explain colour phenomena. The best-known and most widely used (apart from Josef Albers' theories) has been the colour system created by Johannes Itten (***Kunst der Farbe, 1961; The Elements of Color, 1970***). Many people have felt that Itten's views about colours are clear, simple, easy to understand and, at a first reading, even logical. With a closer look, however, one can see that the so-called theoretical laws about colour phenomena and 'colour harmony' presented in the book are not based on any scientific framework. There is simply no empirical evidence to support them.

A modern, educated reader, who observes the world around her with a critical eye, is no longer happy with explanations, such as "[t]he rule of complementaries is the basis of harmonious design because its observance establishes a precise equilibrium in the eye." (p. 49) or "[t]he eye demands the complement to a given hue." (p. 62). What does the rule of complementaries dictate? What is the precise equilibrium in the eye? What does it mean that the eye demands complement hues? Surely, there must be more plausible explanations to colour phenomena.

Working as a lecturer of colour theory for more than 20 years after my revered teacher, painter Onni Oja, at the University of Industrial Arts Helsinki gave me an opportunity to familiarise myself with the prevailing views about colours and the content and methods used to teach them. My growing curiosity over the mechanisms of colour phenomena very soon made me realise that much of our so-called knowledge about colours seemed to be based on mere beliefs and contained visible discrepancy between the theory and the observable reality. For this reason, I saw it appropriate to examine one of the problem areas in more detail, and decided to conduct a study on people's assumptions about colour harmony ("Testing Johannes Itten's hypothesis of a colour contrast theory in a spontaneous choice situation" / "Johannes Ittenin väriharmoniaopin hypoteesin testaus spontaanissa valintatilanteessa", author's unpublished research material). The results proved to be interesting. According to Itten's theory, the 397 subjects involved in my study should have experienced certain colour combinations as harmonic and rated them positively (+). Nevertheless, the vast majority of subjects gave these combinations negative ratings (-) and, moreover, the subjects' answers did not provide any support to Itten's theoretical arguments about colour harmony.

Most of the people who participated in my study were art students oriented towards visual arts, and almost all of them had been introduced to colour theories already in elementary or high school.

So, based on my research, Itten's colour harmony model seemed completely inaccurate – at least in a situation of spontaneous selection. I also quite soon began to suspect that other colour theories based on a 'physicalist' idea of colour were standing on a fairly shaky ground too.

Getting to know Edwin Land's ***Retinex Theory***, also supported my own critical standpoint towards the various 'theories' applied in colour education at that time: Those theories were not to be taken seriously and, to my mind, they were merely pseudo-scientific nonsense. The final thing that convinced me of the legitimacy of my suspicions was an article written by Professor Veijo Virsu in the University of Helsinki's journal 'Yliopisto' (13/92). Virsu's article was titled

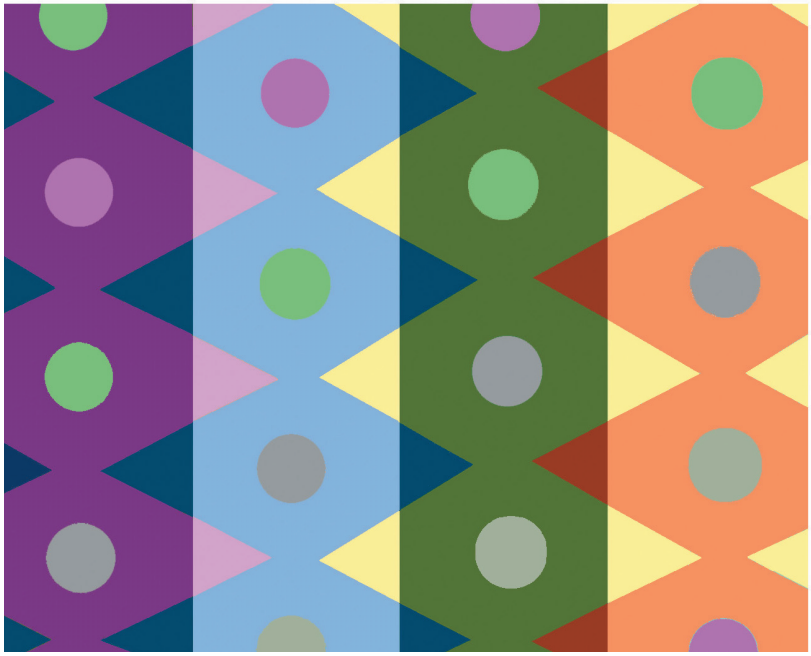
"Goethe's colour theory is unscientific nonsense" and in it the author stated for example that "in the history of science, Goethe's approach is a cautionary example." And that "as science, [Goethe's] research is like a counterfeit coin among genuine ones."

After all this, I find it necessary to ask the following question: How many of us would really like to practice self-deception or, as a teacher or lecturer, deliberately deceive others by turning a blind eye to clearly observable facts?

In this book I handle colour pigments and their evolution very little, apart from some examples in chapters dealing with colour symbolism. Although the subject is very interesting, there is already a lot of information available about them. Neither does the book contain a psychological colour key, a verbal definition of different colours and their meaning, which probably is familiar to most readers from other colour literature. This is because I am certain that a verbal definition of a colour tone without a colour sample and an example of its use (i.e. its context) is bound to produce only vague mental images in the reader's mind and, therefore, lead to misinterpretations.

A hue, which in such a list is called, for example, sky blue, rose red, brick red or olive green, is, regardless of its very accurate-sounding verbal definition, still completely undefined visually. No two people will get the same mental representation of a hue based on just its name. Verbally defined colour is always dependent on individual experiences and interpretations.

Surely, colours can be said to have many expressive features and functions. Nevertheless, it is totally impossible to say, for example, that a certain purple colour sample represents great 'honesty', 'distance' or 'reliability', unless, at the same time, the colour is presented in such a social, historical and cultural context, where the claim can be evaluated.



It's not a visual illusion that, in this image, we see the grey circles as truly different colours, although, from a physicalistic viewpoint, the circles have been printed similar and their CMYK values are exactly the same.

What is Colour?

From Substance to Brain-Centered Approach to Colour

Colours are such an obvious and mundane part of our environment that we don't begin to think about their essence before somebody asks us what they actually are. The most common answers define colour as light, a reflection of light or a wavelength. Sometimes, colour may be defined as a feature of light. These responses show that the person has faced the question before or that the answers have been adopted during some degree of colour education. The answers of people with experience in painting or dyeing almost without exception reflect a view that colour

Take a tour beneath the surface of colours!

A New Groundbreaking Colour Theory

This easy-to-read and versatile book finally explains colour phenomena validly and comprehensively and helps the reader to understand the world of colours surrounding us.

The book is also an excellent colour information manual for demanding readers and experts. It presents a new groundbreaking colour theory that indisputably reveals, how the prevailing colour theories are not true.

"Benaeth the Surfece of Colours is an groundbreaking multidimensional package of information about the world of colours. The book looks at colours and their perception from every possible perspective. This inspring book can be recommended to everybody interested in colours in one way or another." **ARK**, **Finnish Architectural Raview**

"The brain-centred model presented in this book is based on the best knowledge and research available and gives even colour professionals something to think about."
Göte Nyman, Professor of Psychology, University of Helsinki

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