

## A New Colour Primer for Artists and Designers: Integrating Aesthetics and Perceptual Science

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### ABSTRACT

This paper describes a work in progress. It is based on research carried out during 2004 towards writing a book on colour for students of art and design. An important objective was to bring the book's references to colour science up to date. Two further challenges emerged: how to make the content applicable to a variety of art and design professions without sacrificing depth, concreteness and coherence, and finally: how to write a book that would inspire the user to action, to experiment and create with colour in place of passive accumulation of facts.

### 1. INTRODUCTION

A few years back I was given a copy of C.L. Hardin's *Color for Philosophers*<sup>1</sup>. It made me realise that a great deal of the so-called scientific explanations of colour handed down to art students in various colour guides was either false or outdated. Larry Hardin wrote his book for philosophers, one of his aims being to help his colleagues to come to grips with the proper scientific facts of colour – a subject philosophers love to ponder. But philosophers don't *teach* colour. Surely artists and teachers of colour would need this information even more urgently than philosophers! There started my long and arduous journey to try and find out what colour science is all about. Soon I learned that a great deal of it had nothing to do with visual colour, but parts of it seemed highly pertinent to what I and my colleagues have been trying to figure out while teaching.

Teaching basic colour to university-level first and second year art students is extremely challenging. The ideas and approaches instilled at this formative stage tend to direct the students' attitude to colour for the rest of their lives. On the other hand, many of the students will have already studied colour elsewhere and will have picked up bits of knowledge on colour from a great variety of sources. Sometimes the student becomes confused at finding that what she or he has learned previously seems to be in total contradiction to what is being now taught in the colour class.

The situation in my home country, Finland, is further complicated by the lack of up-to-date colour literature in the Finnish language. Most colour teachers have relied on the Finnish translations of Johannes Itten's *Kunst der Farbe*<sup>2</sup> and Josef Albers's *Interaction of Color*<sup>3</sup>, both of which still sell very well in Finland. Partly due to this narrowness in available literature, information on current advances in colour research is not readily available to Finnish lay readers. Another, much lesser problem, is the inconsistency of Finnish colour terminology.

With this in mind, I embarked last year on a project to write a book that could be used for teaching the basics of colour to a wide spectrum of art and design students. From the start it was clear to me that I faced, in addition to the above, two major challenges: 1) How to make the content applicable to a variety of art and design professions without sacrificing depth, concreteness and coherence. 2) How to write a book that would inspire the reader to action, to experiment and create with colour in place of passive accumulation of facts.

No less a challenge was to bring the book's references to colour science up to date. In my brief review of the literature in Finnish and English, I found that books on colour for artists and designers left much to be desired in their accuracy and relevance of scientific quotations and explanations. It is my conviction that, in a basic guidebook on colour, if and when science is used as a premise for aesthetic theory, every care should be taken to check the correctness and relevance of the scientific references.

With the help of a grant from the Finnish Cultural Foundation and with the support of my university, I have been able to devote the most part of last year to background research, reading and producing texts. The book will be published by the University of Art and Design Helsinki and is scheduled to go to print next autumn.

## 2. AIMS

My book's primary purpose is to instil in the reader an understanding of visual phenomena through interplay of visual perception and factual knowledge. Furthermore, the learning process should not stop there, at passive understanding, but should inspire to *creative actions*, to experimentation and sharpening of those visual skills that are most needed in art and design professions. The words should not propagate only more words or thoughts, but colours and images and objects.

Almost every book on colour written for artists begins with chapter on "The Physics of Light" and "The Anatomy of the Eye". A diagram of Newton's prism experiment and a cross-section of the eye seem to be compulsory iconography, repeated almost religiously in book after book. But a diagram of a ray of light refracted into the "seven colours of the spectrum" seems to me redundant unless it is shown to have some bearing on our perceptions.

Many design fields have an intricate relationship with colour that involves specialised knowledge, such as pigment chemistry or colour management in image processing. So physics, chemistry and computer science do enter the picture. But this happens at levels of specialisation and detailed knowledge that no basic book on colour can hope to cover in anything but a superficial and disunited manner. So, is there an aspect of colour that is common to all the art and design disciplines?

After teaching first-year students of a dozen or different professional vocations, I have come to the conclusion that there is. The common denominator of visual colour is not physics or chemistry or the anatomy of the eye, but *perception*. This is why Josef Albers's *Interaction of Color* lives on and is so well suited to teaching design students: it goes straight to point and deals with *perceived* colour in action. But although Albers's method is eminently suited to particular needs, it (and the book) has its limitations. One is the hard-edge, non-textured and mostly geometric scheme or formula of the execution (paper cut-outs) that inevitably breeds a particular (Albersian) aesthetic. The other is that Albers was unable to correctly identify the causes of some of the colour illusions, sometimes preferring wisely to avoid explanations all together.

Fortunately we know much more about these phenomena today, thanks to enormous advances in vision and brain research in the past 25 years. And what is even more exiting is that it has uncovered mechanisms of perception that artist have intuitively known for centuries, without being able to explain their causes. I believe in Semir Zeki's<sup>4</sup> view that art contains an enormous resources of tacit knowledge about perception, even about neurology. But as an educator, I am grateful everytime that knowledge is given utterance.

David Hubel says in the introduction Margaret Lingstone's *Vision and Art, the Biology of Seeing*: "We now know, in broad outline if not in full detail, how the brain begins to deal with the basic components of vision. Our appreciation of the visual arts can only be deepened by such knowledge. In future visual neurobiology will enhance art in much the same way as knowledge of bones and muscles has for centuries enhanced the ability of artists to portray the human body."<sup>5</sup> If Hubel's statement is a little over-optimistic, I still believe that discoveries of neurobiology of the past twenty or so years have the potential to influence art the same way Chevreul's or Helmholtz's discoveries did more than a century ago.

Together with such writers as Semir Zeki, who not only has a profound understanding of art, but is able to also explain the intricacies of the brain to the lay reader, a whole new picture of colour and artistic creation has begun to emerge. In the words of Zeki: "All visual art is expressed through the brain and must therefore obey the laws of the brain, whether in conception, execution or appreciation and no theory of aesthetics that is not substantially based on the activity of the brain is ever likely to be complete, let alone profound."<sup>6</sup>

### 3. THE BOOK

Despite all that I have said about the primacy of perception, my approach would be more practical and eclectic than that of either Itten or Albers. For example: I have included a short chapter on light and colour phenomena in nature (The colours of the landscape) for the simple reason that they are given so little attention in most colour primers, probably because they are usually ascribed to the realm of physics.

I have grouped the subjects of my research and my book under the following topics. This is, of course only a coarse outline and the topics may change as the writing advances:

Seeing and perceiving. Why do we have colour vision? Colour and the brain, colour vision anomalies, colour vision and ageing. The colours of the landscape. Theories of primary colours: RGB, CMYK, opponent colours, etc. Parameters of colour: hue, lightness, saturation and beyond. Ways of mixing colours: additive, subtractive and optical. Contrast: borders, lines and spatial effects. Simultaneous and successive contrast. Gradients and volume. Attributes of Colour: temperature, weight and other associations. Colour harmony, colour preference and taste. Colour as sign and signal. Colour as substance and texture. Identification, classification and measurement of colours. Colour systems and colour spaces. Colour in architectural space. Artificial light sources and colour. Lightness constancy and colour constancy.

Many highly interesting visual illusions, which abound in scientific literature, are rare in art and colour teaching literature: the Hermann grid, The Cornsweet illusion, White's illusion, Adelson's illusions, The McCollough phenomenon ... I would like introduce some of these, where applicable, to artists and designers. Not just as quirks of the brain but as illustrations of our highly intricate and selective visual system.

### 4. UNSOLVED PROBLEMS

Surprisingly little has been written about colour symbolism in a visual context. My feeling is that a deeper study of colour symbolism may lead out of the colour class altogether and towards cultural and social anthropology and perhaps linguistics. What is being said about it in art and design books has made me very sceptical of the quite prevalent notion that the symbolic forces of colours could hold true outside their original context. In other words, I find it hard to believe that colour *per se*, without relation to known forms, subjects and cultural usage, could act as a universal language.

*Colour psychology*, particularly its relation to human emotions and reactions, is a subject that always arouses great interest and speculation in and outside the colour class. It seems, though, that in art books almost anything can and has been claimed about the so-called "*psychophysical*" or *emotional effects of colour*. When it comes to colour psychology, art and design literature seems to collapse into total absence of criticism: New-Age humbug is traded as "fact" and "scientific research" is quoted without references or source criticism. But I know there is also respectable research out there. The work of such scientists as Osvaldo da Pos, Gunnar Tonnqvist, Lars Sivik, Anders Hård and others and the neuropsychological studies of Patricia Valdez and Albert Mehrabian, for example, would merit closer scrutiny from people who ascribe supernatural powers to colour. I feel though, that this is area of colour research is the one that remains the furthest from finding a practical application in art and design.

There is an aversion toward the concept of *colour harmony* among the art theorists of today. This is probably due to it having been (mistakenly) identified with musical harmony for so many centuries. Even Newton identified seven colours in the spectrum because it harmonized with the concept of the seven whole notes of the diatonic scale of music. Later speculations on harmony have taken us a little closer to visual principles of colour organization. Recent neuropsychological studies of neural firing of opponent cells in relation for example complementary colours have brought a new level to this research. But I feel that, all in all, the problem is more on the conceptual side: perhaps one should dispense with the musical word "harmony" altogether and start thinking about other concepts of

aesthetic pleasure or displeasure, “rightness” and “wrongness” or unity and disunity. Perhaps ecology of vision will provide some answers.

Curiously, one of the most difficult things to explain has been colour mixture and the primaries. Why do red and green mix to a brownish grey as paints but to a brilliant yellow as lights? To say that the one mixture is subtractive and the other additive does not really answer the question. In the words of Richard Gregory: “When a painter mixes yellow and blue to produce green, he or she is not mixing lights; but is mixing the total spectrum of colours *minus the colours absorbed by the pigments*. This is so confusing that visual scientists generally forget about pigments and consider only mixing of coloured *lights*... Ignoring pigments is fine for thinking about colour vision and the eye, but rather misses the point for artists mixing paint.”<sup>7</sup> The apparent contradictions between additive, subtractive and physiological primaries and complementaries are not really explained by saying that they belong to three different systems. They of course do not. As far the human observer is concerned, there is only one system, the visual system of the eye and the brain.

## 5. SOME NEW POSSIBILITIES

The discovery of neural pathways for transmitting specialized visual information about the world strikes me as having momentous consequences for the study of art and colour. Artists have always, through abstraction, emphasized such elements as contour, shape, direction, location, depth and facial features, that are now known to have specific loci or systems in the visual brain. The somewhat controversial theory of the “what” and the “where” systems<sup>8</sup>, that in Livingstone’s view underlie for example the curious effect of vibrating boundaries in equiluminant colours, is also a fascinating concept. And gives this phenomenon a completely new interpretation.

In one sense, and an important one, colour is a construct of the brain whose purpose according to Semir Zeki is to extract information about the essential, non-changing aspects of the world from the ever-changing information that is reaching it.”<sup>9</sup> To try to understand the way this information is constructed is to try to see how we see, to unravel the subject and the object, which is a very difficult business. Ultimately the question veers towards philosophy again, which is not the purpose of my undertaking. But if colour and art raise philosophical questions to which the students can offer visual answers, then it can’t have been all in vain.

## References

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- <sup>2</sup> Itten, J., *Kunst der Farbe* (Otto Maier Verlag, Ravensburg, 1961). Finnish translation of paperback version *Värit taiteessa* (Kustannusosakeyhtiö Taide, 1987)
- <sup>3</sup> Albers, J., *Interaction of Color* (Yale University Press, New Haven and London, 1963), abridged Finnish translation with complete texts: *Värien vuorovaikutus*, 1978 and paperback edition 1979, revised second edition 1991 all by Vapaa taidekoulu, Helsinki
- <sup>4</sup> Zeki, S., *Inner Vision: an Exploration of Art and the Brain* (Oxford University Press, London and New York, 2003)
- <sup>5</sup> Hubel, D. in Livingstone, M., *Vision and Art: the biology of seeing*, (Harry N. Abrams, Inc., New York, 2002), p. 8
- <sup>6</sup> Zeki, S., 2003, p. 1
- <sup>7</sup> Gregory, R., *Eye and Brain, The Psychology of Seeing*, Fifth Edition, (Oxford University Press, Oxford 1998), p. 124
- <sup>8</sup> Livingstone, M., 2002, p. 66
- <sup>9</sup> Zeki, S. 2003, p. 11