BOOK REVIEWS


This book was a pleasure to read and is recommended to everyone with an interest in the history of the colorants, especially those used by artists. The book covers the periods beginning with the earliest records and continuing to the present day, although the second half of the 20th century is not covered in the same depth as earlier periods. Vision and technical color receive perfunctory treatment but are not the book’s main strength.

The English author, Philip Ball, majored in chemistry at the University of Oxford, received his Ph.D in physics from the University of Bristol and is currently a consulting editor for the journal, Nature. He has written five other books which dealt with molecular chemistry, new materials, pattern formation in nature and the last one Life’s Matrix: a Biography of Water. His background in chemistry and physics brings a fresh viewpoint to a field dominated by art historians, conservators and those few artists, such as Sir Charles Eastlake, who published research on art materials in 1847.

This book is clearly written with the general reader in mind, but contains enough detail that this reviewer took longer than usual to read it because there were so many bits of information worth jotting down. Considering how little is published on pigments and artists’ paints, we are fortunate that several noteworthy books on these subjects have been published in the last twenty years. These books overlap, and in some ways extend, material covered by this book. However, Bright Earth presents a unique combination of information and felicitous writing.

Individuals who conserve works of art, indeed anyone who needs technical details about historic pigments, will find the beautiful National Gallery of Art series of books on pigments essential. There are three volumes to date, each containing several extensive papers by different conservators on pigments found in early paintings. The first volume of Artists Pigments, A Handbook of their History and Characteristics, edited by Robert L. Feller, was published in 1986. Ashol Roy edited the second volume published in 1993; and the third volume, edited by Elisabeth West Fitzhugh, was published in 1997.

One way to characterize Bright Earth is to compare the information it provides with that given in other books on the same subject. The ancient pigment, Egyptian blue, can serve as an example of how the same pigment is treated in Bright Earth and in Josef Riederer’s section on the pigment in Volume 3 of Artists’ Pigments.

On page 52, Ball addresses Egyptian blue, “The blue pigment known as Egyptian frit or Egyptian blue, which has been identified in artifacts from around 2500 B.C., is not a product of blind chance, a serendipitous outcome of fusing natural materials at random. It is wrought with precision and forethought, a blend of one part lime (calcium oxide) and one part copper oxide with four parts quartz (silica). The raw ingredients are minerals: chalk or limestone, a copper mineral such as malachite, and sand. They are fired in a kiln at temperatures of between 800 and 900 degrees Celsius (1,470–1,650 degrees Fahrenheit). The temperature is crucial, and we must suppose that the Egyptians were able to control firing conditions with considerable accuracy. The result is an opaque, brittle material, which is made into a pigment by grinding it to a powder. It is the oldest synthetic pigment, a Bronze Age blue.”

Riederer also begins by defining Egyptian blue as a calcium copper silicate that has been heated to approximately 850°C. He gives its Colour Index Name and Constitution number and a list of common names that have been used for the pigment at different times and in various countries. He says that the earliest examples of its use come from the Fourth Dynasty (2613–2494 B.C.) including a sarcophagus and the sculptures of Rahotep now in the Egyptian Museum in Cairo. He describes at length its use for the pigment at different times and in various countries. He specifies individual studies and includes tables of analysis by emission spectroscopy, X-ray fluorescence, atomic absorption, neutron activation and X-ray diffraction. A list is given of instances where Egyptian blue has been found outside of Egypt. The paper closes with a bibliography and four pages of references. Ball recounts interesting facts while Riederer defines the pigment.

People interested in contemporary artists and modern artists’ paints, and how these paints effect the painted image, will find The Impact of Modern Paints written by Jo Crook and Tom Learner informative. The paints, however, are discussed only in general terms and pigments are not even listed in the index. While Bright Earth closes with a discussion of new media, this is the starting point for the book by Crook and Learner. Both books refer to Mexican painter, David Alfaro Siqueiros, and his workshops in New York in the 1930’s as the beginning of the use of new media by painters. Both describe the use of Duco and Ripolin enamels, solution acrylic, emulsion acrylic and alkyd paints; sometimes even quoting the same statements made by famous artists. Crook and Learner discuss paints from the viewpoint of the artist, so their book stresses individual artists, their techniques and goals, rather than technical information. Since the authors, like Ball, are English, the artists they cover are Peter Blake, Patrick Caulfield, Richard Hamilton, David Hockney, John Hoyland, Roy Lichten-
stein, Morris Louis, Bridget Riley, Frank Stella and Andy Warhol.


While somewhat weak on current materials, Bright Earth’s strength lies in interesting facts about colorants seen from a chemist’s viewpoint and based on historical research. A random example taken from page 201: “Who would suspect that a pea plant native to India should have anything to do with shellfish in the Mediterranean? Yet the organic compound responsible for the Imperial purpura differs from the blue extract of the Indigofera plant only to the extent of having a couple of bromine atoms where hydrogens sit in indigo. Why shellfish should produce such a close variant of (chemists would say derivative) of a complex substance found in a plant is not at all clear.

The Roman writer Vitruvius refers to indigo in the first century A.D., the first mention of the dye in the West. Pliny says that it is second only to Tyrian purple and hints at the kinship of its rich, dark hue with that of the Imperial color: ‘Indigo . . . comes from India, where it attaches itself as a mud to the foam of the reeds. When it separates in this manner, it is black; on dilution, however, it yields a beautiful blue-purple color. A second kind of indigo floats on the vats in the purple dye houses, which is the foam of purple’. The second kind may be the result of light-induced degradation of the Tyrian purple itself to indigo by loss of bromine . . .”

This discussion of indigo follows a longer and more detailed history of the famous color known as Tyrian or Imperial purple. As the sections quoted above indicate, throughout the book the author fleshes out the connection between chemistry and the technology of a particular period, as shown through the production and use of colorants. The book contains two sections of small color reproductions to illustrate points made in the text. It concludes with notes for each chapter, a bibliography and an index.


JOY TURNER LUKE
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The author is a Professor in the Department of Chemical Engineering at the University of Sherbrooke in Sherbrooke, Quebec, Canada and is a respected researcher in the field of textile chemistry and dyeing. In Basic Principles of Textile Coloration, he has succeeded in the arduous task of clearly explaining the basics of both textile chemistry and color science in a manner that is interesting and useful to either a student of textile science or a chemist who is new to the field of textiles. For the reader who wishes to delve deeper into these subjects, useful references are included at the end of each chapter.

As a teacher of textiles and color science, I am delighted to add this book to my library. It fills a longstanding need for an updated, comprehensive, reader-friendly textbook for undergraduate students or beginning graduate students in textile science. With respect to format and coverage, it is reminiscent of Trotman’s, Dyeing and Chemical Technology of Textile Fibres, which I first encountered some 20+ years ago as a student in a three-course sequence on fiber chemistry, dyeing, and textile finishing. Later, as an instructor, I used selected parts of the 1984 6th edition, the most recent edition of Trotman, as the textbook in an advanced textiles course that I taught for several years. Arthur Broadbent’s book is a welcome replacement for the trusty but dated Trotman work. What is new in this book are the components that address new developments in fibers and dyes, sections on textile printing, water treatment, research in dyeing theory and textile finishing processes, and the basics of color measurement and colorant formulation.

The 25-chapter book begins with an introductory chapter on textiles, dyes, and dyeing, including a brief history the development of dyes and dyeing procedures, an overview of fiber and dye classification and textile manufacturing, and an explanation of the electromagnetic spectrum. This is followed by a chapter on fibrous polymers, in which polymerization of natural and synthetic fibers is explained. Four chapters on fibers detail the chemistry of synthetic, natural cellulosic, manufactured cellulosic, and protein fibers.

The majority of the book, 13 chapters, focuses on dyes and dyeing, including dyeing theory, auxiliary chemicals, water treatment, dyeing machinery, and the particulars of dyeing within each of the various classifications of dyes. A single chapter on printing covers the traditional and some of the newer methods of fabric and carpet printing, but regrettably, does not address recent developments in digital printing of textiles. There is also a single chapter on mechanical, chemical and other methods of textile finishing.

Of primary interest to readers of Color Research and Application are the chapters on color. In a book that covers so many different subjects, the amount of space devoted to color theory and measurement is necessarily limited. There are two chapters that clearly explain the color basics. The first includes a brief discussion of color perception, a more detailed explanation of light sources and illuminants, reflec-

This book is the result of a workshop on the subject held in May 2000 in Leuven, Belgium. The editors are cultural anthropologist/philosopher and, respectively, philosopher and are well known for their strongly negative views on the enterprise of color science. The participants were English, European and some American philosophers, psychologists, science historians, with a smattering of people whose names are known in color science: de Weert, Mausfeld, and Whittle. One might say that all are members of a group blowing the same horn: they are all more or less negative about the achievements of color science.

What are the complaints? To present a quote: “What characterizes this science is not merely that it is a laboratory science, but that its creation, the manufactured phenomenon ‘color,’ is created on the basis of the mathematically defined chromatic model-in-thought. If this is grasped, then the terms of color science—from genes and ganglion cells, through ‘categories,’ to regularities of the terrestrial world—are either absolutely irrelevant or must defend their claim to relevance in other terms. Color science might then admit its contingency and set its hubris and cosmic/genetic schemes aside...” Strong tobacco! But not without kernels of truth, even if not just viewed from the absolutist point of view of its author, Ms. Saunders. Aside from the Introduction by Saunders, the book consists of eleven essays and the same number of responses/commentaries by selected attendants. Even if one cannot take the basic claims seriously (after all, we live in an imperfect world) the book makes interesting and thought-provoking reading.

A key subject that has stimulated Saunders and van Brakel for many years is the theory by Berlin and Kay that color terms in the languages of the world have uniformly developed in the same manner (which van Brakel calls a Panglossian or Whiggish account). The controversy strikes this reviewer as comparable to the nature-nurture controversy about intelligence and other matters of psychology. In the end it seems likely that both biology as well as culture have contributed to the development of color names. Roberson, a psychologist (who has presented her findings also in Rochester last year) and her co-workers report on replication attempts in Papua, New Guinea, and conclude that cultural influences are strongest. In his comments Henselmanns, a philosopher turned computer programmer, attacks the Munsell color chart used in the World Color Survey as constraining the investigation unduly. Why? Because it supposedly imposes an unnatural color language invented in the West on the unsuspecting natives. According to this view such a chart cannot be seen as an assembly of painted papers creating in natural daylight various color experiences but must be regarded as a cultural artifact that has nothing to do with natural color experiences. Color terms are also the subject of the essay by Dedrick and his respondent Costall. Cognitive psychologist, Gellatly, recounts examples from the literature that indicate the largely cultural background of color words. In her comments Saunders attempts to get rid of the small influence of biology that Gellatly grants as a possibility.

In his essay “Contrast colors: a powerful and disturbing phenomenon” psychologist Whittle describes a video screen experiment showing the distinctive effect of surround on field colors. He contrasts such effects (bearing little relationship to experiencing colors in nature) with the tendency of natural objects to maintain their apparent color independent of illumination quality. The appearance of strong contrast requires a certain artificiality of viewing, well known to impressionist painters (viewing surroundings through a
Mausfeld discusses “Attributes of color and elementaristic misconceptions of color representation.” He is a cognitive scientist who has offered the term “elementaristic” to describe the typical color science experiment: viewing simple color fields in minutely controlled surround and illumination conditions in often elaborate unnatural experimental protocols. Guilty as charged! Mausfeld does not believe that such decontextualized patches can be seen as building blocks of color perception. He attacks the conventional attributes brightness, hue and saturation as cultural abstractions (a view supported, incidentally, by Burnham et al. in their book of 1963) and does not think opponent color theories can be building blocks for developing color attributes. He is looking for “representational primitives” as the right kind of building blocks without offering a proposal at this time. He also addresses the issue of color naming and concludes that it is likely based on both biology and culture. In his commentary van Brakel agrees with most of what Mausfeld had to say but takes him to task for believing that biology might have played at least a part in color naming development. He offers an extended listing of examples from several cultures in support of a purely cultural development. The only standardization he sees in color naming is the current trend of many cultures to align their color words with those culturally created in the Anglo-American sphere.

Aristotle’s theory of perception is the subject of the ancient philosophy expert Johansen. He concludes that while this theory emphasizes the passivity of senses Aristotle left some room also for a view of sensory activity. In her discussion Saunders attacks what she calls “automaton color vision” (the result of her interpretation of the activities in color science). Her rather romantic view of vision is that of a “tool [that] handles its objects like hands: it gropes, pokes, grasps, escapes danger and welcomes friends.” In a similar vein Philosopher Kraml interprets Roger Bacon’s explanation of the rainbow. He concludes that Bacon saw the eye not just as a passive object but insisted “the eye has to meet the incoming species in order to accept them and guide them to the brain.” His respondent Wachelder sees Bacon as the forerunner of the technological tradition of cultural interpretation of scientific findings. Philosopher of science Steinle compares Newton’s and Goethe’s color experiments. He views Goethe’s contributions as dealing with “color theory” rather than with physics, as Newton’s do. His respondent Derksen, also philosopher of science, investigates among others the question if Newton was a theory-driven experimenter while Goethe was an exploratory experimenter. He comes to the conclusion that this is a fair distinction but that Goethe had bad luck because “not all that much can be discovered about colors from the purely phenomenological perspective.”

Philosopher Seppalainen asks the question “Was there ever a physiological opponent color code?” and concludes on logical grounds that there is no one-to-one mapping between Hering-type perceptual data and opponent codes as postulated by color science. This is undoubtedly true but hardly news. The reviewer is not aware of a single vision or color scientist that claims to know how unique hues are generated. His respondent Davidoff agrees and concludes that opponent process neurophysiology is not relevant to formation of color categories except perhaps in the case of red and yellow.

In an interesting contribution lecturer in science studies, Johnston attempts to find answers to the question of how, in modern technology, automated instruments came to replace the human eye as arbiters of color specification. It is the lengthy story known to color technologists, from photometers to computer controlled reflectance spectrophotometers. He blames “three rising fashions of quantification, objectivity and automation by physicists and engineers” despite objections by psychologists. But he concedes that color measurement today is “a technological workhorse. . . . And while the physicalist theory has lost its luster, the machines that embody it have more authority today than any pair of eyes.” This is grist for the mill of his respondent van Brakel who demonstrates the subjective character of all proposed color order systems. While he agrees that color is ‘real,’ he describes the color of vision and color scientists as “the social-historical outcome of a development trajectory; a mutual shaping of philosophical presuppositions, scientific theories, experimental practices, technological tools and rhetorical frameworks.” There is undoubtedly some truth in this, but is it the only truth?

In the final contribution, de Weert provides a brief historical sketch of the psychophysics and physiology of color vision. While, for example, in the 1970s color constancy was for Boynton a minor phenomenon it has since been recognized by Land and Zeki as having fundamental importance. Similarly, assimilation and contrast are no longer seen as annoying side effects. These and other examples are presented to demonstrate “that the perception of color cannot be considered as an isolated process.” His respondent, philosopher and physicist Decock, uses the transition from Newtonian to Einsteinian physics as a paradigm for the evolving change from a physicalist view of color to one in which there is nothing a priori about color. In particular, he concludes “phenomenal color space” is not a space. He thinks that line element spaces may be “the clearest proposal for a phenomenal color space.” He also questions the attribution of metric values to distances between colors in multidimensional scaling because these distances “cannot be claimed to represent anything.”

It seems to the reviewer that the basic shortcoming of most of the authors attribute to color science is that it has not explained the working of consciousness. Of course this charge can be leveled against anybody and any other scientific or philosophical community. All our theories and facts are based on suppositions, even those of anthropological and historical perspectives. There are no absolute truths anywhere that we have been able to grasp. While many of Saunders and van Brakel’s arguments are true in a fundamental and absolutist way they shed little or no light on
what color science should be doing differently. The simplictistic physicalist view of color of the mid-20th century has already given way to a more sophisticated view as recent writings by many vision and color scientists show. Unless one is a dualist it is difficult to escape the conclusion that color perceptions are somehow generated by activities of the brain. Pursuing these avenues seems to be a legitimate activity. It remains to be seen if most of the phenomena identified in elementaristic experimentation will not also be found in new kinds of experiments involving natural viewing situations. In general, tearing down is always easier than building up. But to see how one is viewed from a different perspective can be an enlightening experience.

ROLF KUEHN

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Colour Image Science—Exploiting Digital Media. Edited by Lindsay W. MacDonald and M. Ronnier Luo. John Wiley & Sons Ltd. The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, England, 459 pp. $120

Colour Image Science—Exploiting Digital Media is a compendium of papers presented at the Colour Image Science 2002 Meeting held in Derby, England in April 2002. The book’s editors, Lindsay W. MacDonald and M. Ronnier Luo, both of the Colour & Imaging Institute of University of Derby, UK, created a very valuable text and reference book for those involved with digital color science and image reproduction. There are 437 pages and a well-referenced index and a thorough table of contents. The book covers a broad range of subjects; Color Vision, Multispectral Imaging, Image Processing, Gamut Mapping, and, Image Quality. Each chapter includes a number of graphs and illustrations that further explain and clarify the subject. This book will appeal to color scientists and engineers engaged in delivering color imaging and multimedia products or programs. Graduate and post-doctoral students, research libraries, technical directors, and all those who have a burning passion for our world of color would also benefit with a copy in their bookcase.

The book is divided into five parts. Part 1—Colour Vision (76 pages) contains chapters on Perception of Transparency, Investigation of Colour Memory, and Perception of Colour Differences in Large Printed Images. The understanding of our human visual system is that it is trichromatic, that is, it has three channels of information used for collection and transmission. Trichromacy by definition states that it is sufficient for good color reproduction. As advances in vision science unfold and knowledge about human visual performance is gained in addition to the increase in the understanding our human color visual system we begin to understand how to reproduce color. Part 2—Multi Spectral Imaging (72 pages) contains chapters on Evaluation of Multispectral Imaging, Spectral Colour Statistics of Surfaces, A Generalized Method for Spectral Scanner Characterization, and Webcam for Interactive Multispectral Measurements. After reading this chapter it is exciting to see the future of data storage, accurate simulation of color appearance and a more accurate way for color reproduction enfold before our eyes. Part 3—Image Processing (79 pages) contains chapters on Spotting Colours, Colour Contrast on Adjacent Image Regions, Indexing and retrieval in Colour Imaging Databases, and A Spatial Gamut Calculation to Optimize Colour Appearance. This chapter includes the latest research in color appearance modeling. What is exciting here is the inclusion of spatial vision in color appearance modeling. This will be the future of color appearance modeling. Part 4 - Gamut Mapping (116 pages) contains chapters on How different are Colour Gamut’s to Cross-media Colour Reproduction? Gamut Compression Algorithms Based on Experimental Observer Data, A Topographic Gamut Mapping Algorithm, Gamut Mapping for High Quality Print Reproduction and Gamut Mapping Along Curved Lines. Gamut mapping is the process of adjusting the colors of a source gamut to the color gamut of a destination device particularly when the respective gamuts are not similar. Different mapping schemes or algorithms are designed for different purpose and achieve different results. Part 5—Image Quality (80 pages) contains chapters on Modeling Colour Appearance, Spatial Vision and Image Quality, Metric Approaches to Image Quality, Image Quality and Colour Characterization, and How to Make Pictures and Please People. This chapter ties the whole conference together from color vision to image quality. Contextually placing technology and concepts previously presented to make images pleasing. The overview highlights current technological problems and issues, and more importantly, points a direction to a path forward for tomorrow.

There are 12 full-color plates in the book each one helping to illustrate the results or proof of concept. The one that I found most interesting was Plate 8 found on page 304. There are six graphs one for red, yellow, green, cyan, blue and magenta. These graphs diagrammatically show the corresponding changes in the J/C (lightness/chroma) plane as a result of applying a gamut mapping (compression) algorithm. Plate 8, located in the center of the book, shows the graphical representation in full color. Each of the twelve plates colorfully represents a concept.

The technical material in each of the chapters is the latest state-of-the-art information. There are at least three chapters or papers within every topic or part. Each chapter is well written by a notable author in their respected field. What makes this compendium relevant are the topics, the currency of the topics, the development of the topical subject matter, and the experiment and experimental results designed to validate the initial premise. Each chapter concludes with a paragraph that summarizes the current technology or knowledge, and provides a brief glimpse into the future. All the articles are well referenced citing previous works. For in-
stance, Lindsay, *et al*., in their paper, *A Topographical Gamut Mapping Algorithm*, took the first step in developing an algorithm that transforms values from a source gamut to a destination gamut that preserves the source-destination relationship in a reversible manner.

The obvious competition for this book is the proceedings from the IS&T Color Imaging Conference in Scottsdale, AZ. I briefly reviewed the 2001 proceedings. By contrasting the Derby and the IS&T conference one may be able to see the colorful differences between the proceedings. The Derby conference focuses on gamut mapping while the IS&T conference delivers a section with a large number of shorter varied subjects in their “Interactive Session.” Both proceedings contain ample graphs and tables to further explain and supplement the accompanying text. Derby has 12 full color plates, IS&T has 2. Derby has 437 pages, IS&T has 355. Surveying the content and comparing them, both books are excellent with a minimum of overlapping materials.

*Colour Image Science—Exploiting Digital Media* is an excellent book to have on ones bookshelf. Color imaging science is growing rapidly and reference works such as this help us to understand the issues, challenges and opportunities in cross media reproduction.

**Jack A. Ladson**

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