BOOK REVIEWS

Fundamentos de colorimetría. Edited by Pascual Capilla, José M. Artigas, and Jaume Pujol. University of Valencia, Spain, 2002, 228 pp.

Fundamentos de colorimetría (*Fundamentals of Colorimetry*) is the first of two companion books by this group of editors published by the University of Valencia. The second book, entitled *Tecnología del color*, deals with technological color applications and is also reviewed in this issue of *Color research and application*.

In summary, the book on fundamentals is an excellent Spanish-language manual for undergraduate courses (college level), and a good introduction to graduate courses in any of the academic fields related to color, either directly or as a complementary subject. Its judicious selection of topics is more complete than the brief and isolated chapters on color that abound in more general books of optics written in Spanish for scholars of both the basic and applied fields. Given that it does not have sample numerical examples and exercises to be solved by a student, it is not to be considered for use as a proper textbook as it clearly was not designed for that purpose.

The fundamentals of colorimetry are subdivided and presented as seven chapters in the book. After introducing photopic and scotopic characterizations, it is interesting that the first chapter is centered on the notion of "visual trivariance," a concept that combines the classical principle of univariance with the classical trichromacy of human vision. The chapter then goes on to discuss the concepts of color matching functions and cone fundamentals in a clear, didactic fashion. It would have been the preference of this reviewer to broaden the scope of the conclusions in this chapter by briefly calling attention to the fact that other cone fundamentals are important in the academic arena (e.g., Estevez, and Vos & Walraven, whose initial works are actually cited in the bibliography). This, however, does not diminish the goals of the chapter.

Chapter 2 deals with the mathematical representation of tri-stimulus values of colors in a tri-dimensional vector space. The linear formalism is presented clearly and with enough intermediate steps to follow the logic and reach the resulting equations without difficulty. It is useful and refreshing to see color spaces CIE-RGB, CIE-XYZ, LMS, and the color-opponent space ATD as part of a unified mathematical formalism. As introduction to the next chapter, the reader is reminded of one important fact that is often neglected. To a human observer, colors with different color space coordinates may appear the same and colors with the same color coordinates may appear different.

Chromatic adaptation and color appearance are covered in Chapter 3. One highlight this reviewer would like to make note of is Table 3.1 and accompanying Figure 3.1, where a dozen different appearance effects between pairs of colors are listed, characterized, and illustrated with useful plots. Another point that is aptly handled is the fundamental difference between color-opponent models (zone theory) and color appearance models. The chapter ends with another good summarizing table of the models presented and the color appearance phenomena they try to describe.

Chapter 4 addresses the subject of color difference quantification, emphasizing the difference in color appearance. From the classic Mac Adam ellipse approach, through differences in terms of standard color representations CIELUV and CIELAB, it arrives at color difference formulas widely used in current practical applications in those spaces as well as in the color space SVF based on the Munsell color ordering system. Of special interest to many readers may be the comparison of color differences in terms of Mac Adam ellipses, computed for color spaces CIELUV, CIELAB, and SVF. Also informative is the comparison of Munsell value loci in those spaces, using graphs that convey the relative degree of uniformity of those color spaces with respect to color appearance. This information proves a fitting introduction to the topic of the next chapter—color-ordering systems.

Munsell and NCS (Natural Color System) are compared in Chapter 5, followed by discussions on CMYK and Pantone systems from the point of view of color ordering. In addition to the consistent reasoning of presentation, the chapter concludes with an excellent summary of the advantages and disadvantages of using the color atlases derived from color ordering systems to compare and select colors in specific applications.

Chapter 6 is an excellent summary of the main laboratory techniques and basic principles of instrumentation used to measure and calibrate color samples and light. It is updated to include the foundations and current issues regarding fluorescence of materials used as substrates to reproduce color. The foundations and geometrical constraints of colorimeters, spectral-radiometers, and spectral-photocolorimeters are summarized in this chapter. The comments about practical advantages and disadvantages, as well as relative cost, are clearly on target.

It is evident that Chapter 7 serves two purposes: summarizing the principles of color reproduction and providing an introduction to the myriad of issues regarding this topic of major industrial importance. These issues are treated in detail in the companion book. The distinction between additive and subtractive color production and reproduction is explained in the first part of the chapter. It goes on to discuss and clearly compare the different techniques of color printing, from the more traditional to the heavily automatic modern technologies. In the final part, the author takes on the problem of different color gamuts and provides the

reader with a clear explanation of the computational and practical implications for color reproduction.

The book also contains a very practical glossary of colorimetric terms in Spanish taken from CIE publication CIE-1987, as well as a handy appendix of colorimetric tables.

In summary, this reviewer highly recommends *Fundamentos de colorimetría* for Spanish-speaking university students geared towards professions where colorimetry is of the essence. It is also recommended for students and professionals of other disciplines—scientific, artistic, and humanistic—where a good understanding of the fundamentals of color are a key element for a better knowledge of their main topics.

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Tecnología del Color. Edited by José M. Artigas, Pascual Capilla, and Jaume Pujol. University of Valencia, Spain, 2002, 422 pp.

Unfortunately books on color science in Spanish are somewhat rare. Rarer still are those that deal with color-related technologies, particularly those that have emerged in recent years. Therefore, it is of singular importance that two such books have just been published, one dealing with the basics of colorimetry and the other with present-day technologies in which color plays a fundamental role. The book commented upon here, *Tecnología del color* (*Technology of Color*), is the latter.

Although the author of the first chapter deals with some of the basics of colorimetry, the book as a whole is aimed at readers familiar with the subject who should have experience with at least some of the color technologies talked about in the following chapters.

In addition to the introductory chapter, the book contains another ten chapters plus two appendices for tables and figures. The early chapters deal with the most recent technologies to emerge in the world of color, deriving inevitably from the use of computers, monitors, printers, scanners, electronic cameras and the internet, and processes of capturing, managing and reproducing color images. As such, Chapter 2 is devoted to a description of color management systems, Chapter 3 to scanners and electronic cameras, Chapter 4 to the storage and transmission of color images and Chapters 5 and 6 to color reproduction in CRT monitors and printers respectively. All five chapters contain a considerable amount of relevant information on these subjects.

The authors look into different models and colorimetric methods of characterizing image-receiving and reproducing devices, together with the international standards of color technology. As I mentioned above, these chapters are intended for experts, or at least those with some background in the subject, rather than complete novices. The tone of the following chapters changes however.

Chapter 7 is devoted to classical photographic reproduction and Chapter 8 to the expression of color using pigments and dyes. Both include a clearly explained introduction to the subject, giving us a good idea of both the theory and the practice involved, as, for example, with the discussion of the Kubelka-Munk theory in Chapter 8. Chapter 9 engages subjects not usually found in books of this sort: aspects of color related to tests and filters used in optometry and ophthalmology. In both cases, the author offers a concise explanation of their nature and their various applications.

Chapter 10 introduces the reader to color technology in the very extensive field of foodstuffs and their control. The author manages to provide a fairly comprehensive overview, indicating the most important aspects to be taken into consideration.

Although there are no further chapters devoted to one single aspect of the role of color in technology, the editors are obviously aware that there are many other fields, such as textiles and ceramics, in which color plays a vital role. Thus, the last chapter is given over to a detailed description of some of the qualitative and quantitative concepts, such as whiteness, gloss and dullness, involved in other fields. Any reader whose imagination may have been caught by the general information provided in this chapter is encouraged to delve further by reading more specific texts.

Tecnología del color therefore represents a much-needed Spanish contribution to the subject of color and all its ramifications. The up-to-date nature of the subjects discussed make it a book of great interest for those who have experience with the technologies surrounding color and colorimetry but lack some of the deeper scientific knowledge required for a complete understanding of the principles involved. The book's insistence on a basic theoretical understanding is worthwhile and I believe it will prove useful to those who wish to become familiar with one or more of the technologies dealt with here. It is accessible enough to give a very favorable first impression of the subject and at the same time deals with the basic concepts in a precise and assured manner based upon a solid knowledge of the subject concerned.

As often occurs with books written by several authors, there is a certain disparity of style throughout the various chapters, and the odd mistake in an equation here and there, which I am sure will be rectified in future editions.

Overall, the editors have successfully managed to wisely choose and structure the content of this book. *Tecnología del color* constitutes an original and valuable contribution to modern literature on color in Spanish.

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