Color Science and Digital Color Reproduction: Delivering on the Promise

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The reproduction of color as practiced in the graphic arts, professional and consumer photography has undergone a remarkable transformation in the past decade and a half. What was once very much a craft, skill, and art has become a computational process supported by the disciplines of color science, image science, image processing, signal processing, and computer science. The search for a solution to the communication of color information in distributed computer systems that received much attention dating from early efforts at standardization; *e.g.* Office Document Architecture (ODA) has led to a fundamental shift in the measurement basis for color information in digital color reproduction systems. The colorimetric specification of color replaced, in large measure, the device-dependent representations that were based upon sensitometry. This enabled much of the science of human vision to be brought to bear in a computational manner in the process of color reproduction. This has placed new demands on the science of color measurement and the related color spaces which have evolved under the auspices of the CIE. The computational potential of this representation has already produced significant changes in both capture and output devices.

Digital cameras may now contain complex internal pipelines offering a range of processes such as chromatic adaptation computation, color space conversions, and algorithms based on the adaptive processes of the human visual system. Digital printers may have equally complex image processing pipelines. To make this complexity accessible to the user an architectural solution is being sought in the form of color management (International Color Consortium, ICC). The result has been that many of the processes executed by skilled operators have become menu choices or automatic operations that are computationally executed. Much progress has been made in turning color reproduction into a systematic process, but the question remains: How far can this be taken? Much stress has been placed upon colorimetry to provide the foundation for this approach to color reproduction. This keynote will examine what challenges lie ahead for color science and contrast them with the expectations that have emerged in the consumer and professional marketplaces. The subjective nature of color reproduction must be accommodated at the same time as taking full advantage of the objective processes that can simplify and streamline the generation of high-quality color output. What is the role of color science research in realizing this goal? This paper will also offer suggestions as to the logical placement and access for the artistic skills of the professional practitioner in photography and the graphic arts.