CONTENTS

A COLOUR APPEARANCE MODEL FOR COLOUR MANAGEMENT SYSTEMS: CIECAM02

SUMMARY

A colour appearance model provides a viewing condition specific method for transforming tristimulus values to and/or from perceptual attribute correlates. This document outlines a specific colour appearance model, CIECAM02, which may be useful for colour management applications. This model is based on CIECAM97s colour appearance model and consists of a chromatic adaptation transform and equations for computing a set of perceptual attribute correlates. The evolution and application of this colour appearance model are presented.

MODELE D'APPARENCE COLOREE POUR LES SYSTEMES DE GESTION DE COULEUR: CIECAM02

RESUME

Un modèle d'apparence colorée fournit une méthode pour transformer, dans des conditions d'observation spécifiées, les composantes trichromatiques en attributs perceptifs associés, ou réciproquement. Ce document décrit un modèle d'apparence colorée CIECAM02 qui peut être utile pour des applications de gestion de la couleur. Ce modèle est fondé sur le modèle d'apparence coloré CIECAM97s. Il comprend une transformation pour l'adaptation chromatique et des équations pour le calcul d'un ensemble d'attributs perceptifs associés. On présente l'évolution et l'application de ce modèle d'apparence colorée.

EIN FARBERSCHEINUNGSMODELL FÜR FARBMANAGEMENT: CIECAM02

ZUSAMMENFASSUNG

Ein Farberscheinungsmodell beschreibt für spezifische Betrachtungsbedingungen den Zusammenhang zwischen farbmetrischen Werten von Farben und daraus abgeleiteten Größen, welche mit der Farbwahrnehmung korreliert sind. Dieses Dokument beschreibt ein spezielles Farberscheinungsmodell CIECAM02, welches im Bereich des Farbmanagements anwendbar ist. Das Modell ist aus dem Farberscheinungsmodell CIECAM97 entwickelt worden und besteht aus einer Transformation zur Beschreibung einer chromatischen Adaption und aus Gleichungen zur Berechnung der Gruppe von Größen, die mit der Farbwahrnehmung korreliert sind. Die Entwicklung und Anwendung des Farberscheinungsmodells wird vorgestellt.

1. INTRODUCTION

1.1 Overview

This document provides revisions to the CIE interim colour appearance model, CIECAM97s (CIE, 1998; Lou et al., 1998c). It also provides the forward and inverse equations for this revised model, referred to as CIECAM02. Relevant terminology is presented and the evolution and development of the model are presented. The specific revisions are described and some guidelines and examples for setting the model parameters are presented. Finally, the forward and inverse equations are provided with a worked example.

1.2 Purpose

The objective of this document is to provide a single set of revisions to the CIECAM97s colour appearance model. It also provides additional information regarding the derivation and use of this model for practical applications. This document should provide the necessary level of detail for specific implementations of the forward and inverse colour appearance model as appropriate.

1.3 Scope

Colour appearance models (Fairchild, 1998) are a large area of research in the field of colour science. There is a need however for a single colour appearance model for colour management systems. This model should balance complexity and functionality. One of the strengths of CIECAM97s is that it has provided a common benchmark for researchers to compare results and focus recommendations for improvements and refinements.

This document provides only a colour appearance model for colour management systems. It does not provide guidance for gamut mapping (Morovic et al., 2001), colour preference (Holm, 1996) or other topics (Pearson, 1986) related to colour management. Background information is provided with respect to basic terminology and evolution of the model but it is assumed that the reader is familiar with the basics of colour science (Hunt, 1998; Berns, 2000) and colour management. For additional information regarding the complexities of gamut mapping and colour encoding, interested readers should refer to CIE, 2004 and CIE technical committee 8-05, Communication of colour information.

There are a number of possible applications for this model and it is informative to provide a partial list of potential uses. Gamut visualisation is a critical aspect of evaluating the colour capabilities of a given device or process. CIECAM02 can be useful for comparison of device gamuts based on a set of perceptual attribute correlates. It is also possible to use CIECAM02 as the colour space for gamut mapping. Use of CIECAM02 does not define the domain or range of the mapping or the specifics of the mapping but again it provides perceptual attribute correlates for gamut mapping. As with CIELAB (CIE, 1986), it is also possible to use CIECAM02 for interpolation, quantization, compression and other applications. However, use of CIECAM02 for these applications will require a full understanding of the processing requirements, such as processing speed, memory requirements, and so on. CIECAM02 has been shown to have superior blue hue constancy relative to CIELAB and CIELUV (CIE, 1986). The blue to purple shift evident in CIELAB and CIELUV are significant perceptual non-uniformities that are considerably improved for CIECAM02 (Moroney et al., 2003).

2. TERMINOLOGY

A *colour appearance model* provides equations and methodologies for transforming physically measurable quantities to and from viewing condition specific perceptual attribute correlates. At a minimum the model should consist of a chromatic adaptation transform and equations for perceptual attribute correlates. This document specifies how CIE tristimulus values can be converted to and from perceptual attribute correlates. A *perceptual attribute correlate* is a fundamental uni-variate colour description or metric. CIELAB and CIELUV provide equations for lightness, chroma and hue. CIECAM02 specifies formulae for lightness, brightness, chroma, saturation (Hunt, 2001), colourfulness, and hue.