ROCHESTER INSTITUTE OF TECHNOLOGY
Munsell Color Science Laboratory

SIMC 703 Color Appearance
Wednesdays, 9:00AM-12:00N, 18-1080

Throughlines:

1) When and why does colorimetry apparently fail?

2) How do we measure and predict color perception in complex environments?

3) What is the dimensionality of color and what are the dependent and independent variables?

Texts:

Required: J. Long and J.T. Luke, *The New Munsell Student Color Set*, Fairchild Books, New York, (2001). *(Available from Val for $50.)*
Encouraged: M.D. Fairchild, *Color Appearance Models*, Wiley, Chichester, (2005). *(Available from Val for $95.)*

Lecture Schedule:

Papers are to be read prior to lecture for which discussion is scheduled. See reading list for complete references. Relevant background chapters from the text (2nd edition) are listed in parentheses.

3/15/06	First Class Meeting, Pick Up First Readings, Discuss Course, MDF Overview Lecture *(Chs. 1,2,3)*
3/22/06	Long & Luke; Wright; Wyszecki; Hard & Sivik; Newhall. *(Chs. 4,5)* *Munsell Set Due for Review*
3/29/06	Bartleson; Purdy; Fairchild & Pirrotta. *(Ch. 6)* *Term Paper Topic Due*
4/5/06	Hunt; Helson; Stevens & Stevens. *(Ch. 6)*
4/12/06	Fairchild; OSA; von Kries. *(Chs. 6,7)*
4/19/06	Helson, Judd, & Warren; Wright; Fairchild; Neitz *et al*. *(Chs. 8,9)*
4/26/06	Nayatani *et al.*; Hunt; Hunt; Fairchild *et al*; Fairchild. *(Chs. 11,12,13)*
5/3/06	CIE; Fairchild; CIE. *(Chs. 15,16)*

5/10/06 Luo *et al.*; Hunt *et al.*; Mori *et al.*; Alessi; Braun *et al.*; Li *et al.* *(Ch. 17)* (Mark @ ICIS, Rochester)

5/17/06 Granger; Zhang *et al.*; Zhang *et al.*; Johnson *et al.*; Fairchild *et al.* (Ch. 20) (Mark @ ISCC/CIE, Ottawa)

5/24/06 **Finals Week**
Term Paper Presentations (Mark Out of Town?)

Course Requirements:

1) Each week one student will prepare a one-hour presentation summarizing the week's papers and facilitating discussions. The presentation, interrupted with discussions, will fill the 3-hr. session. Students will sign up for dates at the first class meeting.

2) Brief (~2 pp. total per week) summaries of the papers are due each week. These must be turned in at the lecture during which the papers are discussed. Each week's presenter is not required to turn in a summary.

3) The Munsell Student Set must be completed for review on 3/22/06.

4) Term paper due 5/22/06 (Monday of Finals Week) by 5:00PM. The topic is to be an in-depth treatment of some specific area of color appearance in more detail than covered in class. Preliminary title with brief explanation due on 3/29/06.

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READING LIST:

Course Texts

J. Long and J.T. Luke, *The New Munsell Student Color Set*, Fairchild Books, New York, (2001).

M.D. Fairchild, *Color Appearance Models, Second Edition,* Wiley-IS&T Series in Imaging Science and Technology, Chichester, UK (2005).

Basic and Advanced Colorimetry

W.D. Wright, 50 years of the 1931 CIE standard observer for colorimetry, *AIC Color 81*, Paper A3 (1981).

G. Wyszecki, Current developments in colorimetry, *AIC Colour 73*, 21-51 (1973).

Color Appearance Terminology

A. Hard and L. Sivik, NCS—Natural Color System: A Swedish standard for color notation, *Color Res. Appl.* **6**, 129-138 (1981).

S.M. Newhall, Preliminary report of the O.S.A. subcommittee on the spacing of the Munsell colors, *J. Opt. Soc. Am.* **30**, 617-645 (1940).

C.J. Bartleson, Brown, *Color Res. Appl.* **1**, 181-191 (1976).

Color Appearance Phenomena

D.M. Purdy, Spectral hue as a function of intensity, *Am. J. Psych,* **43**, 541-559 (1931).

M.D. Fairchild and E. Pirrotta, Predicting the lightness of chromatic object colors using CIELAB, *Color Res. Appl.* **16**, 385-393 (1991).

R.W.G. Hunt, Light and dark adaptation and the perception of color, *J. Opt. Soc. Am.* **42**, 190-199 (1952).

H. Helson, Fundamental problems in color vision. I. The principle governing changes in hue, saturation, and lightness of non-selective samples in chromatic illumination, *J. Exp. Psych.* **23**, 439-477(1938).

J.C. Stevens and S.S. Stevens, Brightness functions: Effects of adaptation, *J. Opt. Soc. Am.* **53**, 375-385 (1963).

M.D. Fairchild, Considering the surround in device-independent color imaging, *Color Res. Appl.* **20**, 352-263 (1995).

Viewing Conditions

OSA, Psychological concepts: Perceptual and affective aspects of color, Chapter 5 in *The Science of Color*, Optical Society of America, Washington, 145-171 (1963).

Chromatic Adaptation

J. von Kries, Chromatic adaptation, *Festschrift der Albrecht-Ludwig-Universität*, (Fribourg) (1902) (Translation: D.L. MacAdam, *Sources of Color Science*, MIT Press, Cambridge, (1970)).

H. Helson, D.B. Judd, and M.H. Warren, Object color changes from daylight to incandescent filament illumination, *Illum. Eng.* **47**, 221-233 (1952)

W.D. Wright, Why and how chromatic adaptation has been studied, *Color Res. Appl.* **6**, 147-152 (1981).

M.D. Fairchild, Chromatic adaptation to image displays, *TAGA* **2**, 803-824 (1992).

J. Neitz, J. Carroll, Y. Yamauchi, M. Neitz, and D.R. Williams, Color perception is mediated by a plastic neural mechanism that is adjustable in adults, *Neuron* **35**, 1-20 (2002).

Color Appearance Modeling

Y. Nayatani, K. Takahama, H. Sobagaki, and K. Hashimoto, Color-appearance model and chromatic adaptation transform, *Color Res. Appl.* **15**, 210-221 (1990).

R.W.G. Hunt, Revised colour-appearance model for related and unrelated colours, *Color Res. Appl.* **16**, 146-165 (1991).

R.W.G. Hunt, An improved predictor of colourfulness in a model of colour vision, *Color Res. Appl.* **19**, 23-26 (1994).

M.D. Fairchild and R.S. Berns, Image color appearance specification through extension of CIELAB, *Color Res. Appl.* **18**, 178-190 (1993).

M.D. Fairchild, Refinement of the RLAB color space, *Color Res. Appl.* **21**, 338-346 (1996).

CIE, The CIE 1997 Interim Colour Appearance Model (Simple Version), CIECAM97s, *CIE Pub. 131* (1998).

M.D. Fairchild, A revision of CIECAM97s for Practical Applications, *Color Res. Appl.* **26**, 418-427 (2001).

CIE, A Colour Appearance Model for Colour Management Applications: CIECAM02, *CIE Pub. 159* (2004).

Testing Color Appearance Models

M.R. Luo, A.A. Clarke, P.A. Rhodes, A. Schappo, S.A.R. Scrivner, and C.J. Tait, Quantifying colour appearance. Part I. LUTCHI colour appearance data, *Color Res. Appl.* **16**, 166-180 (1991).

R.W.G. Hunt and M.R. Luo, Evaluation of a model of colour vision by magnitude scalings: Discussion of collected results, *Color Res. Appl.* **19**, 27-33 (1994).

L. Mori, H. Sobagaki, H. Komatsubara and K. Ikeda, Field trials on CIE chromatic adaptation formula, *Proceedings of the CIE 22nd Session*, 55-58 (1991).

P.J. Alessi, CIE guidelines for coordinated research on evaluation of colour appearance models for reflection print and self-luminous display comparisons, *Color Res. Appl.* **19**, 48-58 (1994).

K.M. Braun and M.D. Fairchild, Testing five color appearance models for changes in viewing conditions, *Color Res. and Appl.* **22,** 165-174 (1997).

C.J Li, M.R. Luo, R.W.G. Hunt, N. Moroney, M.D. Fairchild, and T. Newman, The performance of CIECAM02, *IS&T/SID CIC 10*, Scottsdale, 28-32 (2002).

Spatial Models

E.M. Granger, Uniform color space as a function of spatial frequency, *SPIE* **1913**, 449-461 (1993).

X. Zhang and B.A. Wandell, A spatial extension of CIELAB for digital color image reproduction, *SID Digest.* **19**, 27-33 (1996).

X. Zhang and B.A. Wandell, Color image fidelity metrics evaluated using image distortion maps, *Signal Processing* **70**, 201-214 (1998).

G.M. Johnson and M.D. Fairchild, A top down description of S-CIELAB and CIEDE2000, *Color Res. and Appl.* **28,** 425-435 (2003).

M.D. Fairchild and G.M. Johnson, The iCAM framework for image appearance, differences, and quality, *Journal of Electronic Imaging* **13**, 126-138 (2004).