

Challenges and rewards of teaching an online color science course

ISCC Online Seminar

Dec 5, 2016

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Introductions



Mike Murdoch



Susan Farnand

We Want Questions & Discussion

To avoid audio issues...

Please stay muted

Please post questions using
the Questions/Chat window

If necessary, we can unmute
to discuss further



RIT is Online

8,426 online enrollments

10% of all course sections

6% of all credit hours

27% of students take an online course

16% of faculty teach an online course



<https://www.rit.edu/ritonline/>

The screenshot displays the RIT Online website interface. At the top, the RIT logo and name are on the left, and 'Directories' and 'Search RIT' are on the right. Below this, the 'RIT ONLINE' logo is prominent, followed by a navigation menu with 'COURSES' (highlighted), 'PROGRAMS', 'ABOUT', 'HOW IT WORKS', and 'CONTACT'. A search icon is also present. Under the 'COURSES' section, there are filters for 'FIELD OF STUDY', 'COURSE LEVEL', and 'ALL COURSES'. The 'FIELD OF STUDY' filter is active, showing a list of categories. The first category, 'Art, Crafts, Design, and Visual Communications', is expanded, showing an 'ALL COURSES' button. Below this, three course cards are displayed:

- Gender, Science, and Technology**
Starts: Jan 23, 2017
Length: 16 weeks
Remaining: 0 Seats
- American Popular & Rock Music**
Starts: May 30, 2017
Length: 10 weeks
Remaining: 32 Seats
- Civil War America**
Starts: May 30, 2017
Length: 5 weeks
Remaining: 32 Seats

At the bottom, another category 'Business, Management. and' is partially visible, along with a row of four small images representing various fields of study.

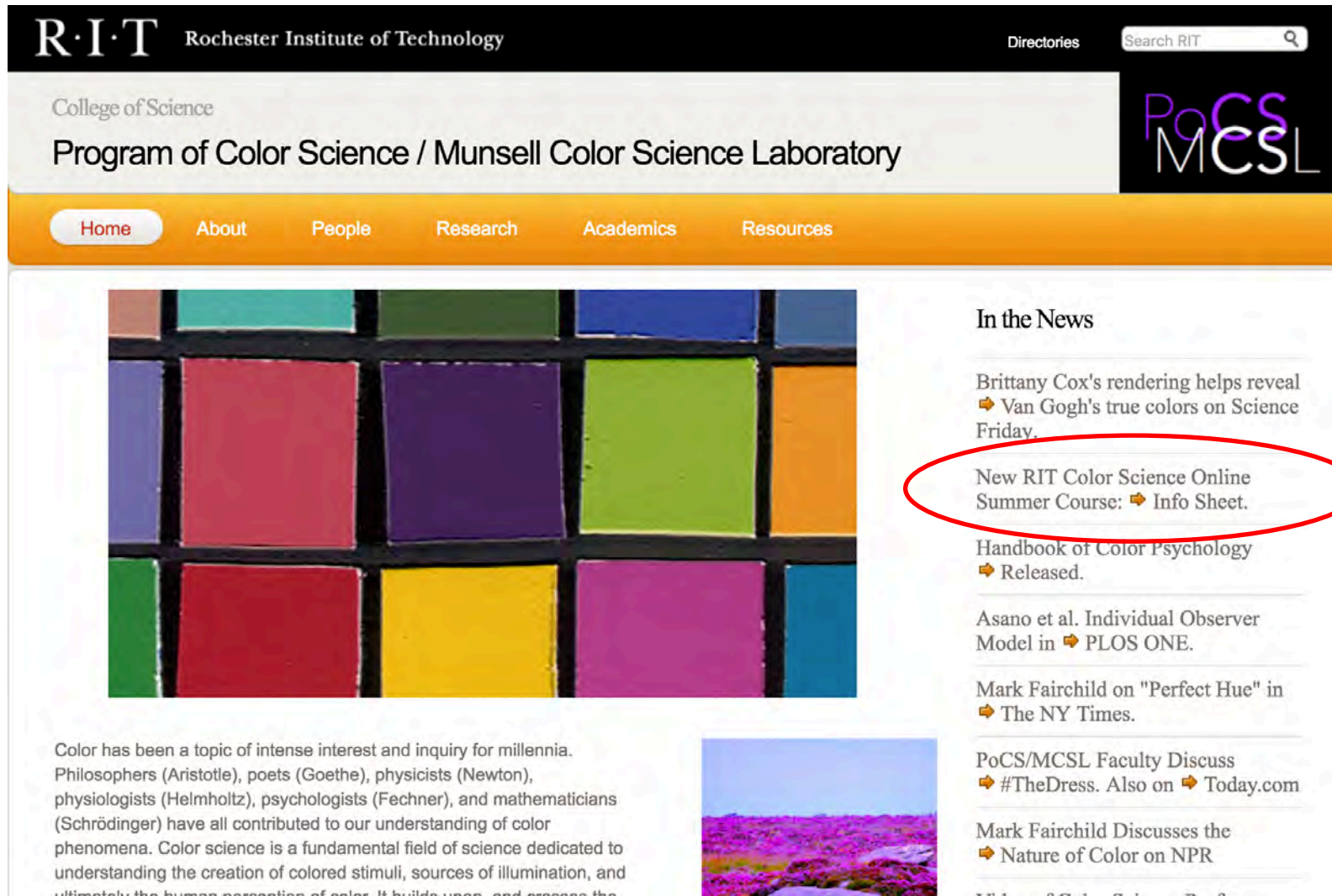
Colleges must have
online presence, but
teaching – and
learning – online is
not always easy



[http://eco-
logicsolutions.co.uk/view/12b62ef9f6501affa196cafa6194f314](http://ecologicssolutions.co.uk/view/12b62ef9f6501affa196cafa6194f314)

MCSL is Online

<http://mcsl.rit.edu>



R·I·T Rochester Institute of Technology

College of Science

Program of Color Science / Munsell Color Science Laboratory

Directories Search RIT

Home About People Research Academics Resources

Color has been a topic of intense interest and inquiry for millennia. Philosophers (Aristotle), poets (Goethe), physicists (Newton), physiologists (Helmholtz), psychologists (Fechner), and mathematicians (Schrödinger) have all contributed to our understanding of color phenomena. Color science is a fundamental field of science dedicated to understanding the creation of colored stimuli, sources of illumination, and ultimately the human perception of color. It builds upon, and expands the

In the News

Brittany Cox's rendering helps reveal
✦ Van Gogh's true colors on Science Friday.

New RIT Color Science Online Summer Course: ✦ Info Sheet.

Handbook of Color Psychology
✦ Released.

Asano et al. Individual Observer Model in ✦ PLOS ONE.

Mark Fairchild on "Perfect Hue" in
✦ The NY Times.

PoCS/MCSL Faculty Discuss
✦ #TheDress. Also on ✦ Today.com

Mark Fairchild Discusses the
✦ Nature of Color on NPR

http://www.rit.edu/cos/colorscience/ac_ssc.php

R·I·T Rochester Institute of Technology

Directories


College of Science

Program of Color Science / Munsell Color Science Laboratory

PoCS
MCSL

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Summer Online Course



In Summer Term 2017, PoCS/MCSL will be offering a 3-credit, online, graduate course, CLRS-600 Fundamentals of Color Science. This course is an asynchronous online course providing a technical introduction to color and the CIE system of colorimetry. The topics covered are listed below. The course is intended for students with a technical background who are interested in adding an elective course in color science to their graduate program and for practitioners in the field interested in a more thorough understanding of the science behind color. This course cannot be taken for program credit by Color Science MS and PhD students. (Prerequisite: Bachelor's degree in a STEM discipline).

Fundamentals of Color Science

- Color 'triangle' - Light sources, sensors, objects
- Color order systems
- Vision
- Light
- Photometry

- Online Admissions Application
- Details on our Ph.D. program
- Details on our M.S. program
- Graduate Studies Office
- Thesis/Dissertation Guidelines
- Summer Online Course**
- The Color Curiosity Shop

CLRS.600.01 - Fundamentals of Color Science

Content Calendar Classlist Groups Dropbox Discussions Chat Surveys Quizzes Grades

Content Browser ▾

🔖 Bookmarks 📄 Recently Visited

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-  Readings >
-  Color Order Systems Project >
-  Color Vision Project >
-  Color Measurement Project >
-  Colorimetry Project >

Early Alert ▾



Access Early Alert

Faculty, student and advisor access to RIT's early alert system.

- Documentation:

Instructor Contact Info ▾

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News ▾

There is no news to display.

Updates ▾

There are no current updates for
CLRS.600.01 - Fundamentals of Color
Science

Calendar ▾

Course Structure

10 weeks, each including:

- 2 readings
- Quiz per reading
- Online discussion
- Mini-project or online activity
- Deliverable: 3-5 page project report

Week 10 project is student's choice

Reading List

Week	Reading	Due Date
1	Newton	6/3
	Fairchild – Color Order Systems	
2	Fairchild – Vision	6/10
	Hunt – Light sources	
3	Berns – Color Measurement	6/17
	Berns – Precision and Accuracy	
4	Reinhard - Colorimetry	6/24
	Wright – 1931 observer	
5	Berns – uniform color spaces	7/1
	Luo – CIEDE2000	
6	von Kries – Chromatic Adaptation	7/8
	Reinhard – Color Appearance vocabulary	
7	Reinhard – Color Appearance phenomena	7/15
	Fairchild – CIECAM02	
8	McCamy – Macbeth ColorChecker	7/22
	Fairchild & Wyble – Display Characterization	
9	Johnson – color management	7/29
	Reinhard - HDR	
10	Hunter – gloss	8/5
	Fleming - translucency	

Quiz Example

CLRS.600.01 - Fundamentals of Color Science

Content Calendar Classlist Groups Dropbox Discussions Chat Surveys Quizzes Grades

Color Vision - Preview

Time Limit: 0:30:00 Time Left: 0:28:11 Michael Murdoch: Attempt 1 Exit Preview

Questions

0 of 4 questions saved

Page 1:

1

Page 2:

2

Page 3:

3

Quiz Status

Nothing to Save

Question 3 (1 point)

Why are cones important for visual acuity?

☐ a) The ganglion-to-cone ratio is higher than the ganglion-to-rod ratio

☐ b) There are many more cones than rods

☐ c) The cones are more sensitive than the rods

☐ d) The cones are densely packed in the retina

Save

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Some Interesting Discussions...

Regarding Color Differences:

“... the amount of difference, it is not specified in which direction, towards which color/hue.”

Regarding Macbeth Color Checker:

“40-year-old color checker patches are designed for color film response... should we design a new color checker corresponding to our current digital camera or display?”

CLRS.600.01 - Fundamentals of Color Science

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Overview

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Course Schedule

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Color Order Systems Project



Color Vision Project



Color Measurement Project



Colorimetry Project



CIELAB project

1

Color Difference project



Color Order Systems Project ▾

Print

⌚ Due June 6 at 11:00 AM

Please complete the activity below. Click on the link. Further instructions are included in the activity.

Download

Send to Binder

100 % 2 of 2 topics complete



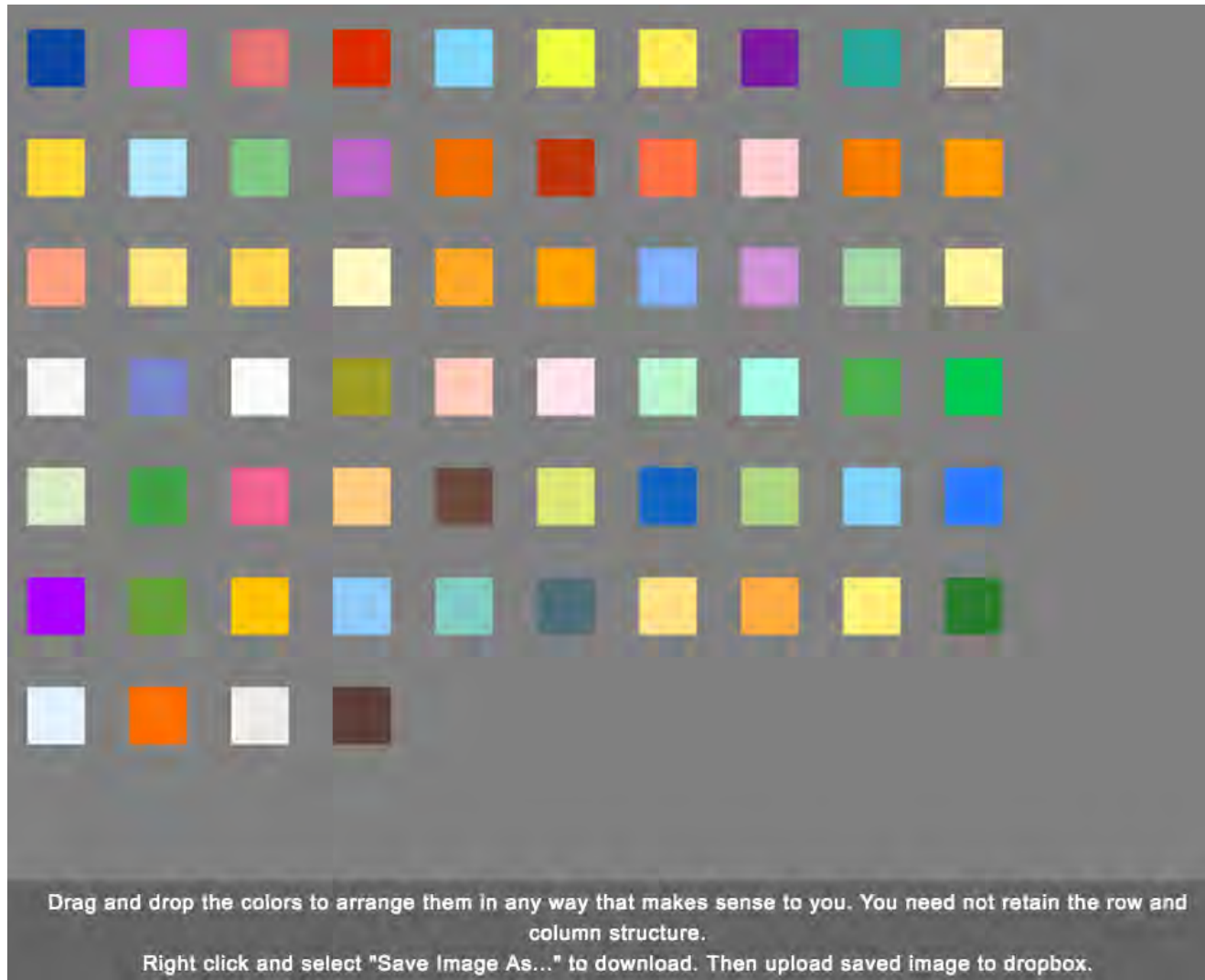
Color Order Online Activity ▾



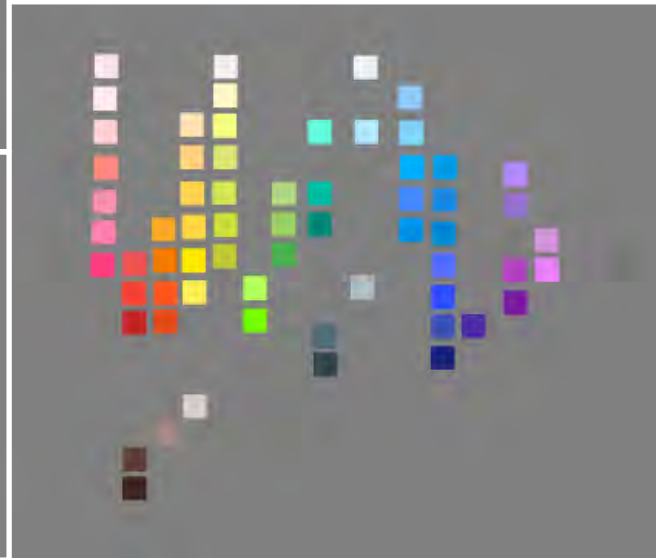
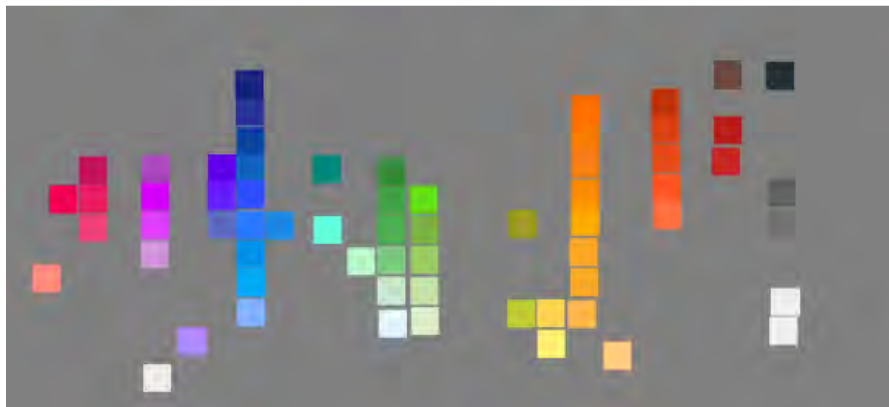
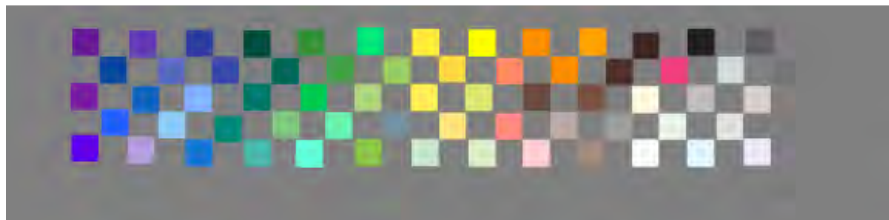
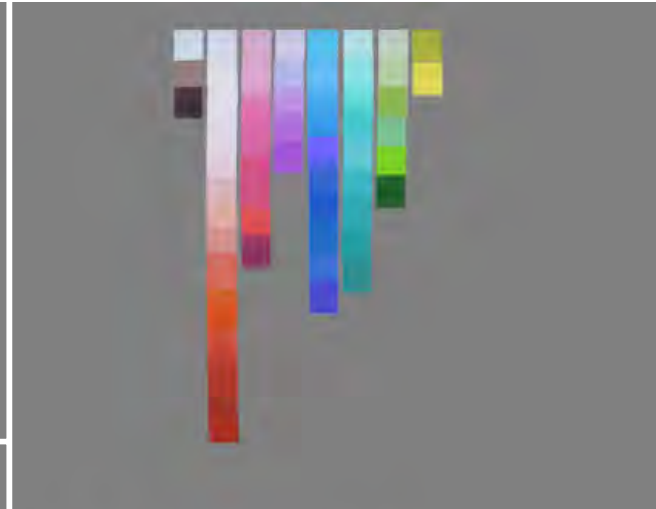
Color Order Systems (video) ▾



Color Order Systems Mini-Project

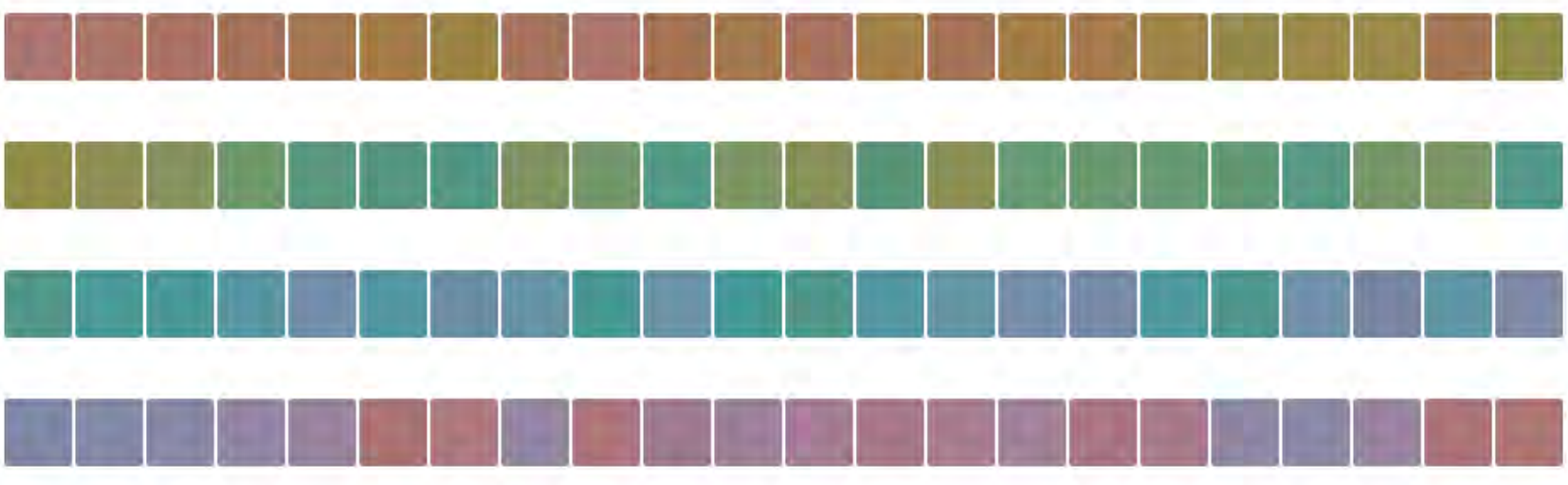


5 Students' Color Orderings



Color Vision Project: F-M 100 Hue Test

Farnsworth-Munsell 100 Hue Color Vision Test

Introduction	Instructions	Test	Test Score	Interpretation	Comparison Group
					
<input type="button" value="I'm done"/>					

<http://www.color-blindness.com/farnsworth-munsell-100-hue-color-vision-test>

Colorimetry & Lab Overview



Colorimetry & Lab Overview



Color Measurement Project

No hands-on lab experience!

Spectral reflectance data file provided
*(as if students had measured them with
the spectrophotometer)*



Color Measurement

Development of a virtual spectrophotometer underway

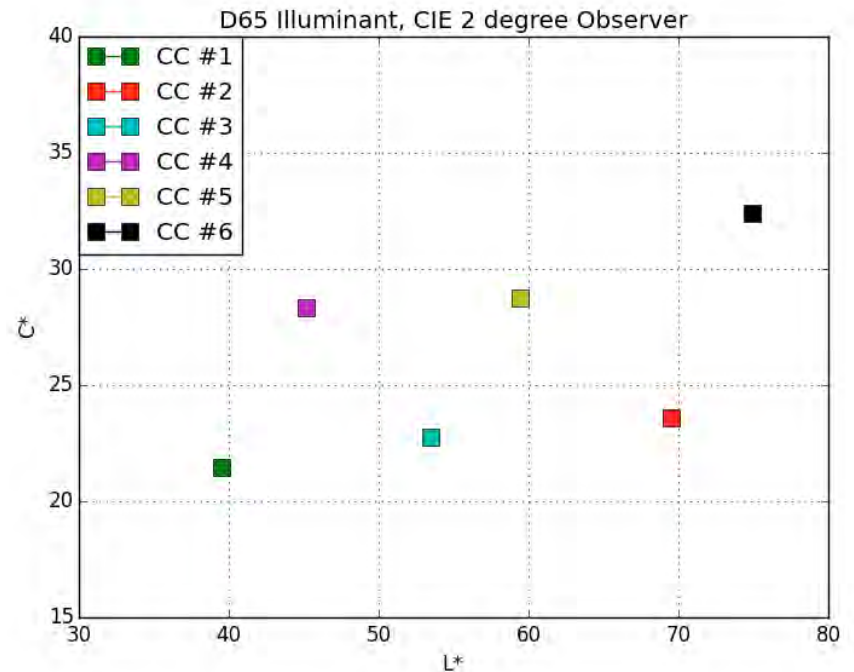
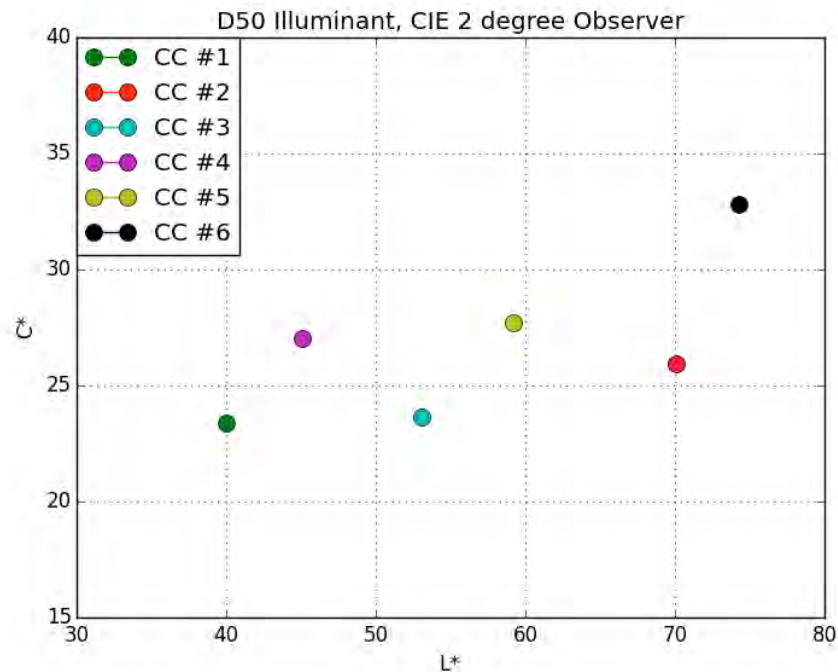
- Calibration
- Drag-and-drop “Sample shelf”
- Spectral data plot
- Download data files with pre-computed variability

Colorimetry and more...

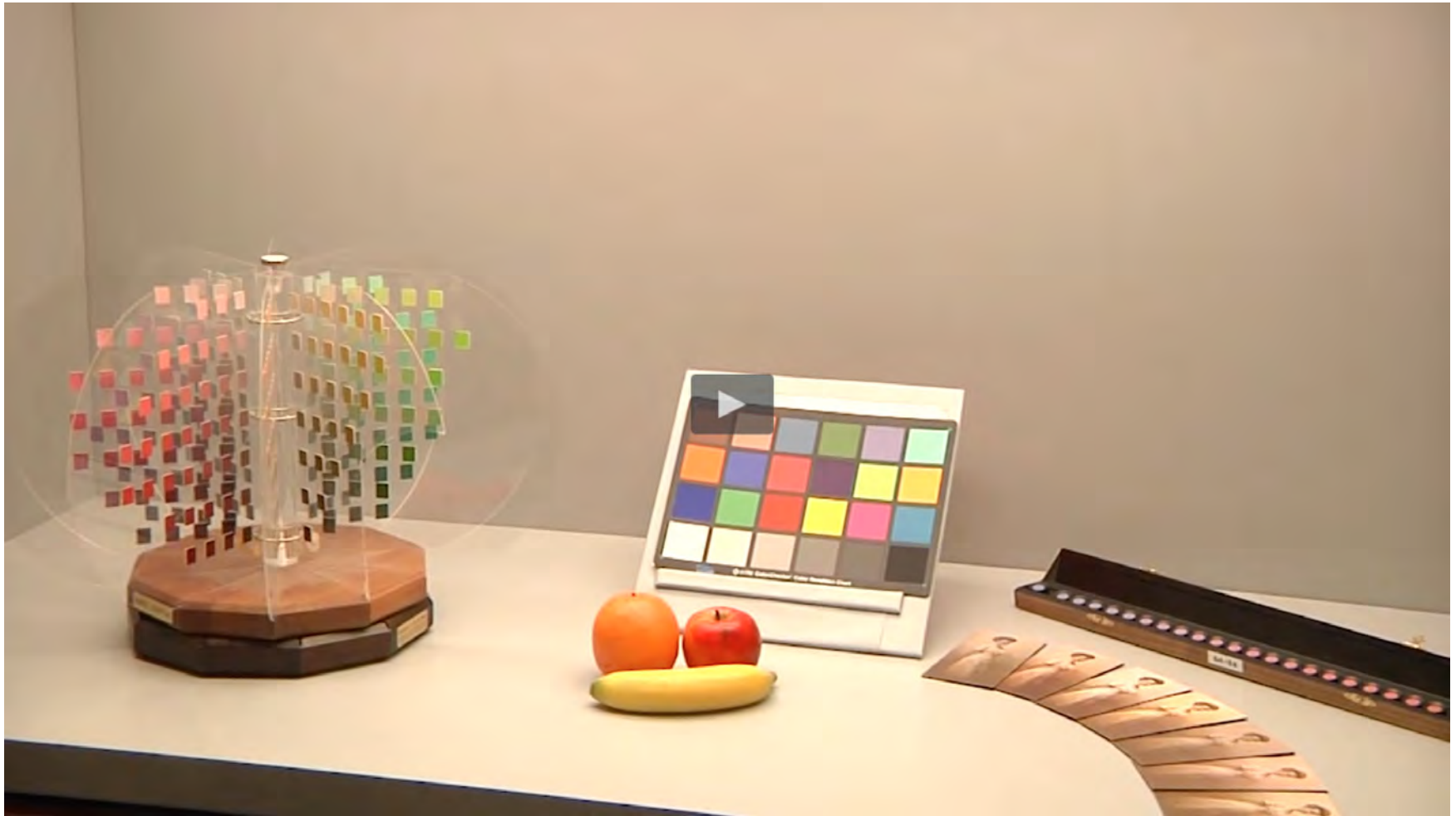
- With the color measurement data, students calculated tristimulus values, chromaticities, CIELAB values, and, using these, the impacts of changing light sources and observers



CIELAB example results



Chromatic Adaptation & Color Appearance



Color Systems

- Color display characterization
- Color management



Questions or Comments?

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<http://www.drawing-factory.com/feedback/>