

CIE TC8-04 Meeting (November 16 1999) Minute

Prepared by Peyma Oskoui and modified by Naoya Katoh

1. Meeting of CIE TC8-04 “Adaptation under mixed illumination conditions”

Chair: Mr. Naoya Katoh (Sony Japan)

November 16 1999, 19:00-21:00 Scottsdale, AZ. At 7th Color Imaging Conference

Opening the meeting, Naoya Katoh, CIE TC8-04 chair distributed printouts of:

- 3 Sony sRGB standard Images
- Katoh’s algorithm on his model for mixed mode adaptation
(Excel file at http://www.colour.org/tc8-04/Spread_sheets/S-LMS_test.xls)
- List of fluorescent (F series) spectral values (at <http://www.colour.org/tc8-04/Data/F.txt>)

Elizabeth Pirrotta and Peyma Oskoui (members from Hewlett Packard Labs, CA) distributed a copy of a presentation (which will also be put on the web: http://www.colour.org/tc8-04/Contributions/MIND_TC804.pdf) regarding their model for mixed mode adaptation.

2. Introductions

- Dr. Joann Taylor, Color Technology Solutions, Oregon
- Mr. Naoya Katoh, Sony, Japan [naoya@color.sony.co.jp]
- Dr. Ellen Carter, Minolta, New Jersey
- Mr. Todd Newman, Canon, California [todd_newman@cisnc.canon.com]
- Mr. Elie Khoury, France [eliekhoury@compuserve.com]
- Ms. Elizabeth Pirrotta, Consultant, California [pirrotta@exch.hpl.hp.com]
- Dr. Peyma Oskoui, Hewlett Packard, California [peyma@hpl.hp.com]
- Dr. Dave McDowell, Kodak, New York [mcdowell@kodak.com]
- Dr. Paula Alessi (via phone), Kodak, New York [pjalessi@kodak.com]

3. Discussion

3.1 Oskoui-Pirrotta AWP model

Ms. Pirrotta and Ms. Oskoui introduced their method for determining mixed mode adaptation. Ms. Pirrotta used the printouts (to be put on the TC8-04 site) and slides from their presentation at the CIC conference to explain the following points about their method:

- Method used in monitor to monitor comparison
- Psychophysical experiment called MIND (multi-stimuli interactive neutral-point determination) was explained
- The 4 viewing conditions tested were described (Dark VC, sRGB VC, two *typical* office VCs)
- Results:
 - method accurate within less than 1 E.
 - Use of D65 white point for sRGB VC is acceptable.
 - Use of D65 white point for Office II (D93 monitor under CWF ambient illumination at about 700lux on desktop) is not too far off and may be appropriate (verification needed).
 - An adapted white point model (preliminary) based on monitor chromaticities and ambient luminance is developed and tested. The results are compared with 4 other models and the z-scores show that this model rates favorably among the other available AWP methods.

Mr. Newman commented that Kumada et al from Canon had presented a similar research at the 6th CIC conference in 1998 (Proceedings of the 6th IS&T/SID Color Imaging Conference, pp.123-128).

Ms. Pirrotta noted that the AWP model developed using MIND is a preliminary model that needs more work and verification.

Mr. Katoh stated that there is a difference between Partial Adaptation (concerned with degree of adaptation to monitor white point) and Mixed Adaptation (an intermediate point between two or more sources of illumination – CIECAM97s does not provide a fix for this case). Mr. Katoh also noted that in Oskoui-Pirrotta comparison of adapted white point

models, memory-matching technique is used for the softcopy/softcopy situation, which relies on complete adaptation to the current viewing condition. Mr. Katoh pointed out that in a softcopy/hardcopy situation, side by side matching is usually employed, where there is no time for complete adaptation.

Ms. Pirrotta also mentioned that although the images compared did have a white margin around them, the width of these margins plays an important role in adaptation, and at quarter inch width, degree of adaptation to the monitor is a lot higher. (Oskoui-Pirrotta used 1/8th inch white margins.) Ms. Carter reiterated the importance of the borders, and Mr. Katoh said that the agreement at Warsaw was to use 5mm (about 0.2 inch) borders as a proximal field

Mr. Newman also iterated Mr. Katoh's point that in a softcopy versus hardcopy case adaptation times change all the time, and the issue seems to be one of control. Ms. Alessi said that 60 seconds is enough time for complete adaptation, and Ms. Pirrotta said that in hardcopy versus softcopy cases, people often look at the print and/or monitor only for a fraction of that time. Mr. Katoh pointed out that in such a case, then the ambient chromaticities also become an important factor.

Ms. Alessi asked whether the Oskoui-Pirrotta model should be used as basis for the mixed mode adaptation problem.

Mr. Katoh pointed out that the Oskoui-Pirrotta model could be regarded as a special case of Katoh et al model, where full adaptation occurs at fixed state. He confirmed that the Oskoui-Pirrotta model is a good basis for this work, but that there is no need for other members to revisit their research.

Ms. Alessi offered that the Oskoui-Pirrotta AWP model should be used as another existing model, which is applied to various cases and conditions. She said that this model should be analyzed and refined and that the evolution of this model could be valuable. All other present agreed.

3.2 Color Appearance Model Used, Adaptation Time

Mr. Katoh pointed out that his research uses Hunt-Pointer-Estevéz model, but CIECAM can theoretically be applied to his work as well. He suggested that other committee members could examine his work within the CIECAM framework.

Members agreed on the use of CIECAM from now on, and it was agreed that the new model for CIECAM, Cam97s2 must be used from now on. ("The CAM97s2 Model," Proceedings of the 7th IS&T/SID Color Imaging Conference, pp. 262-263)

Mr. Katoh also suggested, based on Mr. Newman's comment, that the Kumada research (Proceedings of the 6th IS&T/SID Color Imaging Conference, pp.123-128), which does use CIECAM model should be reviewed by members. Another suggestion was that in order to incorporate ambient illumination into CIECAM model, perhaps employ a new parameter which determines a midpoint between monitor and ambient white points.

Ms. Pirrotta mentioned that their model always assumes complete adaptation, and hence D factor of 1.0. Mr. Newman suggested that Ms. Oskoui and Ms. Pirrotta should share their data with the committee, and Ms. Pirrotta pointed out that the psychophysical AWP used is in the CIC proceedings (pp.101-105).

3.3 Adaptation Issues

The next issue discussed was that of the softcopy versus hardcopy adaptation time. The question was put to Mr. Katoh on the way his observers compared hardcopy image to the softcopy image. Mr. Katoh said that they did not put the print next to the CRT, but rather held the print at a 45-degree angle from the desktop and not very close to the CRT. He said that the observers looked at the prints about about 3 seconds at a time.

Ms. Alessi asked if the agreement was on use of simultaneous binocular method of observation, and on not using fixation. Mr. Katoh pointed out that in his experiment, they were concerned with the typical-use case. Ms Alessi said that if they continually scan across both media, rather than fixate on either one, then after 1 minute, they would adapt to the mixed mode situation (based on Fairchild's chromatic adaptation thesis work). Ms. Pirrotta pointed out that the user would eventually walk away from the CRT and will look at his print without the presence of CRT and hence adapt to the print. Mr. Katoh said that his assumption has been 100% adaptation to the print, and a mixed-mode adaptation to the softcopy.

Mr. Newman pointed out that this discussion shows that there are 3 situations really:

- Monitor under ambient,
- Monitor vs. hardcopy,
- Hardcopy alone, with no monitor,

And so the question is, which situation are we trying to solve for.

Mr. Katoh said that for a 20-inch screen, we usually do not adapt fully to the monitor. He also acknowledged that Mr. Newman's point is a valid one, but we do not have an answer for his question so far. Mr. Newman said that it would be nice to have a continuum on these 3 viewing conditions (mentioned above).

Mr. Katoh urged the members to observe how users use the hardcopies and how they compare the print to the softcopy. Mr. McDowell said that in graphics arts people use their hardcopy proof next to their screen, and keep shifting their focus to/from the proof. Mr. Newman countered that in consumer market, users stare at the monitor for long periods of time, for example to fix up their images using Photoshop.

Mr. Khoury said that he and his group had experimented with the best visual match of print to monitor both at the same illumination. Results show that:

- People always use print as their reference – they expect the monitor to match the print.
- Good matching conditions were achieved when Luminance of monitor and the viewing booth were equivalent – seems that the adaptation occurs to the brightest white in the observer's visual field.

Mr. Katoh agreed that luminance level is important, but cautioned that in consumer market there is much less control over this than in the graphics arts market.

Mr. McDowell said that perhaps one of the (secondary) tasks of the committee should be to come up with bounds. So if the viewing condition is not within the set bounds, it is expected that the adaptation will be poor. Mr. Newman and Ms. Pirrotta ventured that the primary task should be to come up with adaptation models for each way of observation.

3.4 Standard Images

Mr. Katoh proceeded to explain the 3 standard Sony images that he had distributed among the members.

- Party_4s: Woman in white and table set with various metallic, liquid, and colorful objects. A Macbeth color chart is also in the picture.
- Portrait_4s: Same woman, in lacy white dress, holding a bouquet of flowers.
- Picnic_4s: 3 women (black, Asian, white) on a picnic outdoors, lying on grass with blue sky and trees in the background.

These 3 images will be put on the web.

All members liked Picnic_4s very much.

Mr. Katoh cautioned that any standard images used should not contain highly saturated (as in business graphics diagrams) colors. He said that he would like to have 3 or 4 default images to be used by all members. Ms. Alessi said that Kodak's approach is to distribute prints. Ms. Alessi will look into obtaining sRGB digital images. Mr. Katoh asked all members to try and provide images. This became the objective by the next committee meeting.

It was noticed by some members that resolution of the image has effects on the color appearance. Great care should be taken when the image resolution is changed. It was decided that device resolution and interpolation methods be reported along with experimental results.

Mr. Katoh also had distributed a printout of an Excel spreadsheet, which calculates Katoh et al model step by step. (Available at http://www.colour.org/tc8-04/Spread_sheets/S-LMS_test.xls) Input parameters are: XYZ_CRT, XYZ_n_CRT, XYZ_Amb, Rbk, and R_adp. The values of the two matrices used can be changed.

Ms. Alessi asked for a similar Excel spreadsheet for the CAM97s2 model. (This will be action item for Katoh.)

Mr. Katoh then described the last handout, the Fluorescent Spectral values, also available on-line at <http://www.colour.org/tc8-04/Data/F.txt>. Mr. Katoh said that in his research he had used F2, but Schanda and Stokes had asked for F10 or F11 which are more popular according to CIE experts' opinion. So F11 is the fluorescent of choice, and F10 is ranked slightly below F11.

Mr. McDowell pointed out that the current available mercury is changing, and that the numbers from current mercury bulbs should be compared against these published F11 values. Ms. Alessi agreed to investigate any drifts from CIE F11 in current bulbs. Mr. Newman suggested that any researchers should also measure their F11 bulbs, so that it is known what they exactly used. Mr. Katoh added that the F11 should be measured on the faceplate. All members agreed on this.

Mr. Khoury pointed out that the TLD840 is the F11 series from Phillips.

Although it was suggested to use F11 as default, spectral sensitivity of the illuminant should be measured and reported along with experimental results.

Mr. Katoh suggested that 80-100cd/m² should be used as luminance level for CRT (on the faceplate), and 80-100cd/m² luminance should be used for prints (held at 45-degree angle from desktop) as a default setting and 200-300 cd/m² could be used as an optional setting.. Ms. Pirrotta mentioned that CIE has an office work area standard of 500-700 cd/m² on the desktop. She added that she would look up the exact numbers and the exact reference. She also said that the viewing condition can be set to whatever the standard is, and then the print can be measured at a 45-degree angle in that environment. It should be confirmed how measurement method affects the luminance level.

Mr. Katoh concluded that Ms. Alessi and Ms. Pirrotta should check the guidelines for F11 and office work environment, and they agreed.

Mr. Katoh also suggested that CAM97s2 should be used, and that addition of a parameter to handle the white point of a mixed mode situation should be looked into.

He also said that a comparison of the two methods of memory-matching and simultaneous binocular for the same experiment could be conducted in order to see how the results of the two methods differ. If these results do differ significantly, perhaps another parameter should be added to the appearance model, taking into account the matching technique used.

With these remarks, Mr. Katoh thanked all the participants, and the meeting was closed at 8:52pm.

4. Conclusions

Accept Oskoui-Pirrotta AWP model as another existing model: further test it, and compare it to other models. Oskoui and Pirrotta will continue research into the improvement of their model, and its possible uses in softcopy/hardcopy cases.

Use of new CIECAM model, CAM97s2 for future experiments by the members in AWP determination. (proceedings of the 7th IS&T/SID CIC conference, pp.262-263)

Kumada et al research (proceedings of the 6th IS&T/SID CIC conference, pp.123-128) should be looked into as a way of using CIECAM in mixed mode illumination.

It was reiterated that the white borders for images should be 5mm (about 1/4 inch).

Given the three distinct cases of: Monitor under ambient illumination, softcopy/hardcopy matches, hardcopy alone with no CRT, it was agreed that although all three are out of the immediate scope of the committee, but they all do comprise various viewing conditions with distinctly different AWP's, and eventually the research of committee members should propose AWP models for each of these ways of observation.

3 standard sRGB Sony images were distributed, and will soon be on web. It was agreed that all members should strive to get such standard sRGB images (in digital format) and distribute it amongst the members. Hopes being that 3 or 4 default images will be chosen from a total of 10 or so submitted.

P. Alessi (Kodak) will look into obtaining sRGB digital images.

P. Oskoui (HP) will also look into obtaining digital images. (As of this writing, current HP digital images can become public domain only after a 6-month period. Will keep looking into this matter).

An Excel spreadsheet of CAM97s2 is needed, just like the one that N. Katoh distributed on his model (and which is on the web), and combination of mixed adaptation and CAM97s will be investigated. -> Katoh's action item

F11 will be used as standard fluorescent from now on. If F11 is not available, then F10 will be used.

It was agreed that spectral values (on the CRT faceplate) of the fluorescent lamp (that will be used for the visual experiments) should be measured and reported, so as to see how much it deviates from the CIE F11 spectral values.

P. Alessi will look at TLD840 Phillips F11 series to determine how deviant they are from CIE F11.

E. Pirrotta will look at the CIE standards for office work-area ambient illumination.

Research needs to be done in accessing the differences in results of memory matching versus simultaneous binocular matching. If results are significantly different, then perhaps a new parameter needs to be added to CIECAM to specify the matching method used.

It was acknowledged by members that CIECAM as it is today does not address mixed mode illumination situations adequately, and hence extra parameters may have to be introduced into CAM97s2 to achieve the desired adaptation under mixed mode situations.