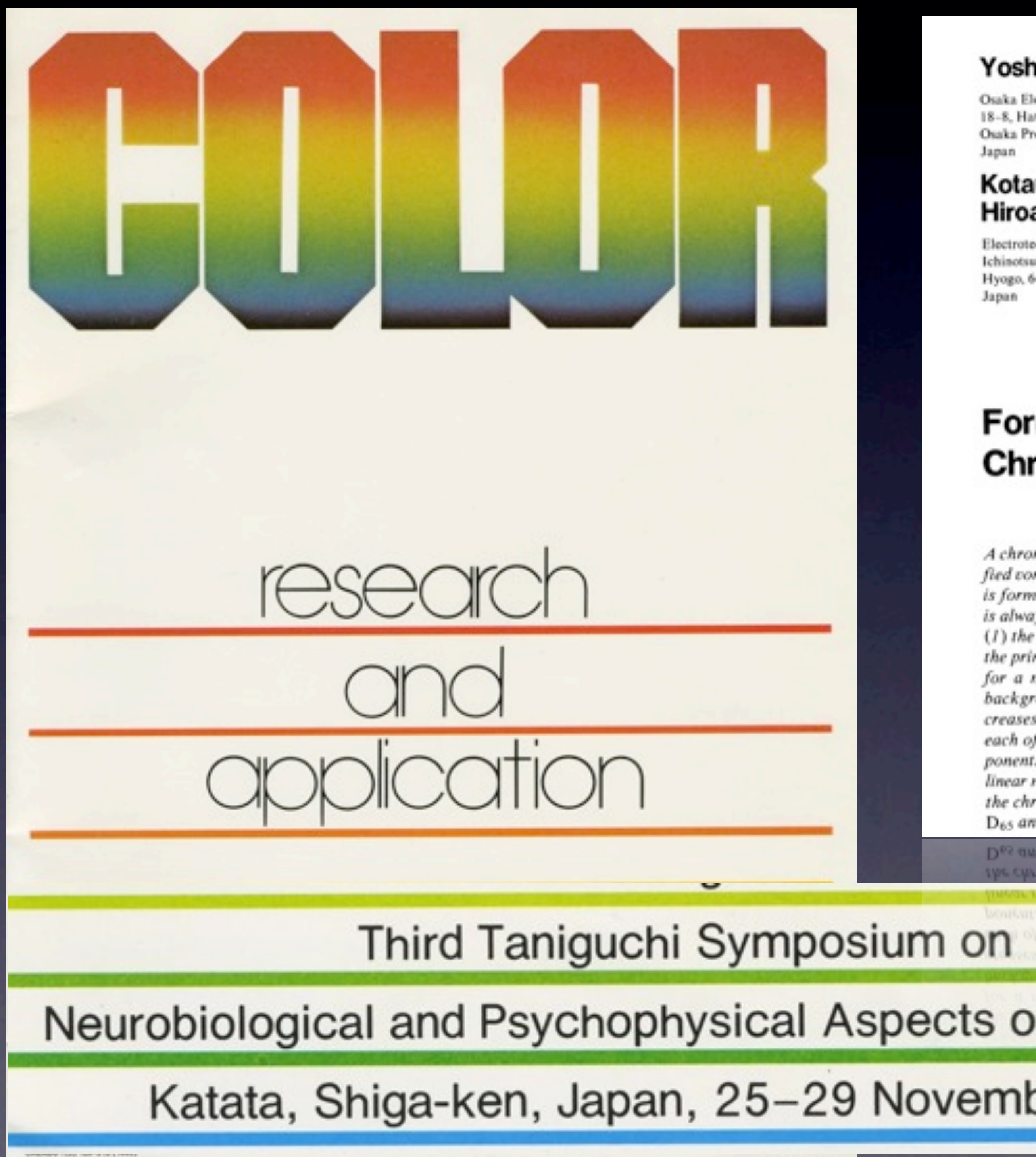
納谷先生と
ヘルムホルツ・コールラウシュ効果

千葉大学融合科学研究科
矢口博久

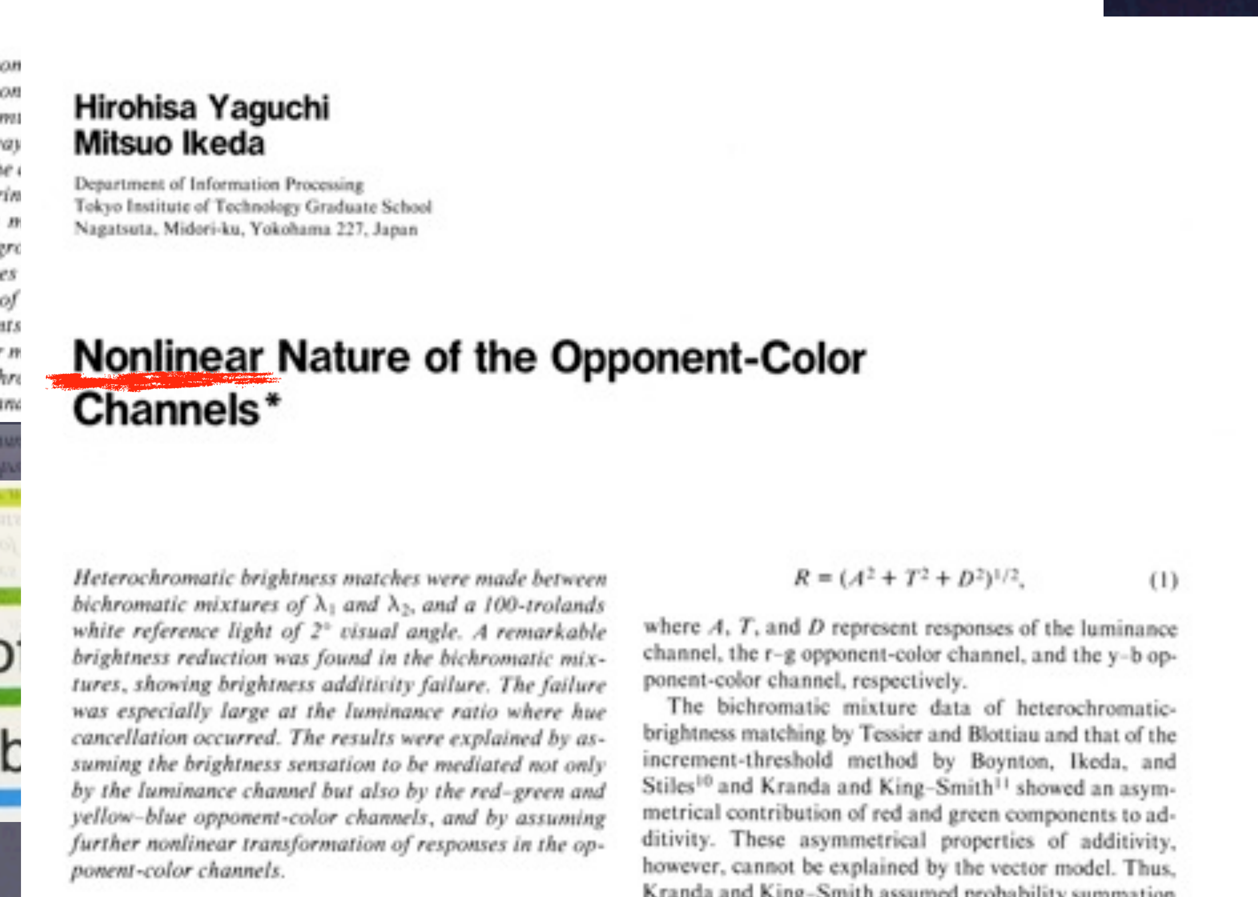
納谷先生との最初の接点 (1980)




Yoshinobu Nayatani
Osaka Electro-Communication University
18–8, Hatsu-cho, Neyagawa City
Osaka Prefecture, 572
Japan

Kotaro Takahama
Hiroaki Sobagaki
Electrotechnical Laboratory, Osaka Branch
Ichinotsubo 1–1, Nakoji, Amagasaki
Hyogo, 661
Japan

Formulation of a Nonlinear Model of Chromatic Adaptation*


Hirohisa Yaguchi
Mitsuo Ikeda
Department of Information Processing
Tokyo Institute of Technology Graduate School
Nagatsuta, Midori-ku, Yokohama 227, Japan

Nonlinear Nature of the Opponent-Color Channels*

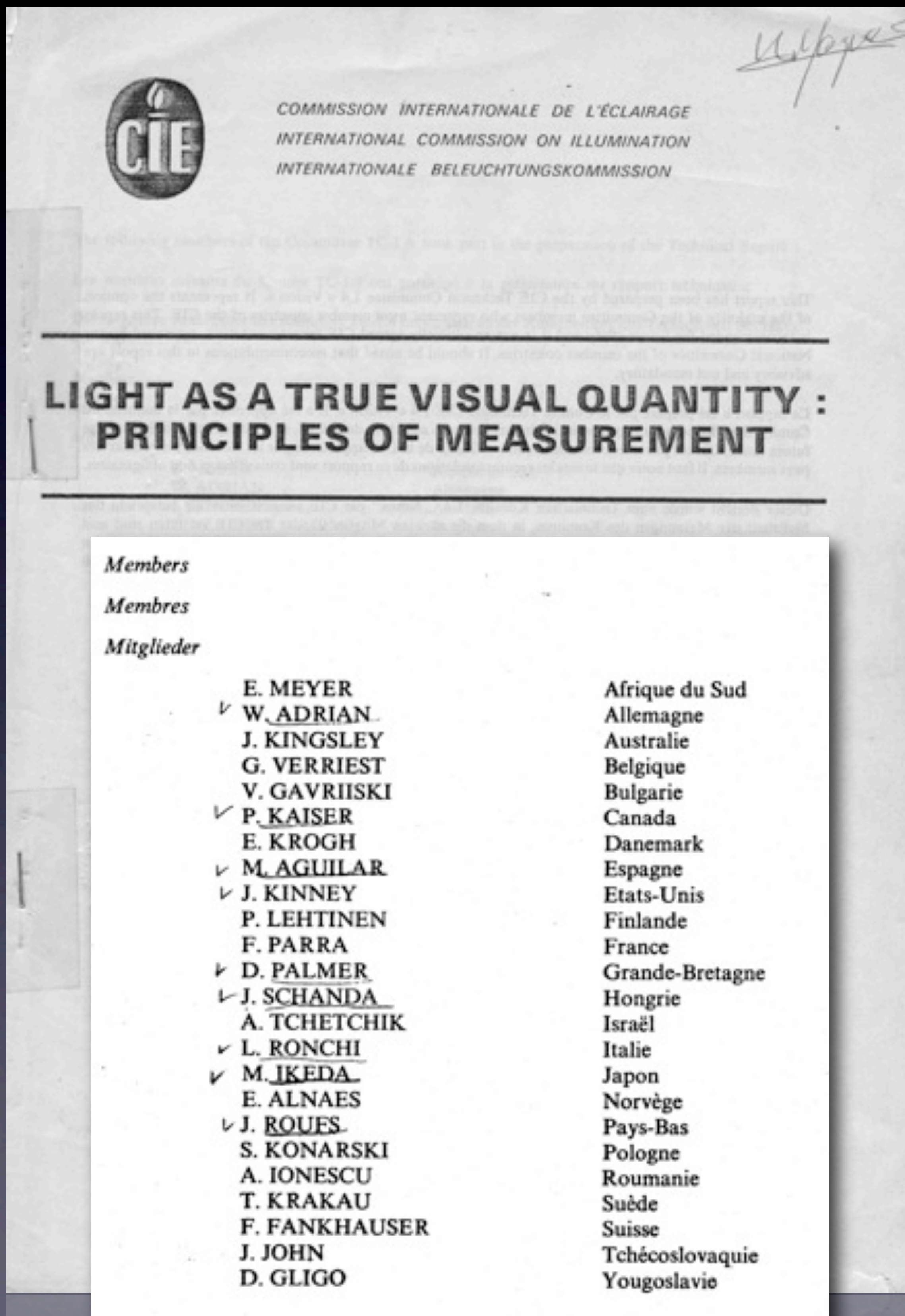
Heterochromatic brightness matches were made between bichromatic mixtures of λ_1 and λ_2, and a 100-trolands white reference light of 2° visual angle. A remarkable brightness reduction was found in the bichromatic mixtures, showing brightness additivity failure. The failure was especially large at the luminance ratio where hue cancellation occurred. The results were explained by assuming the brightness sensation to be mediated not only by the luminance channel but also by the red–green and yellow–blue opponent-color channels, and by assuming further nonlinear transformation of responses in the opponent-color channels.

$$R = (A^2 + T^2 + D^2)^{1/2}, \quad (1)$$

where A, T, and D represent responses of the luminance channel, the r–g opponent-color channel, and the y–b opponent-color channel, respectively.

The bichromatic mixture data of heterochromatic-brightness matching by Tessier and Blottiau and that of the increment-threshold method by Boynton, Ikeda, and Stiles[10] and Kranda and King–Smith[11] showed an asymmetrical contribution of red and green components to additivity. These asymmetrical properties of additivity, however, cannot be explained by the vector model. Thus, Kranda and King–Smith assumed probability summation

私の「明るさ」の研究のスタート



COMMISSION INTERNATIONALE DE L'ÉCLAIRAGE
INTERNATIONAL COMMISSION ON ILLUMINATION
INTERNATIONALE BELEUCHTUNGSKOMMISSION

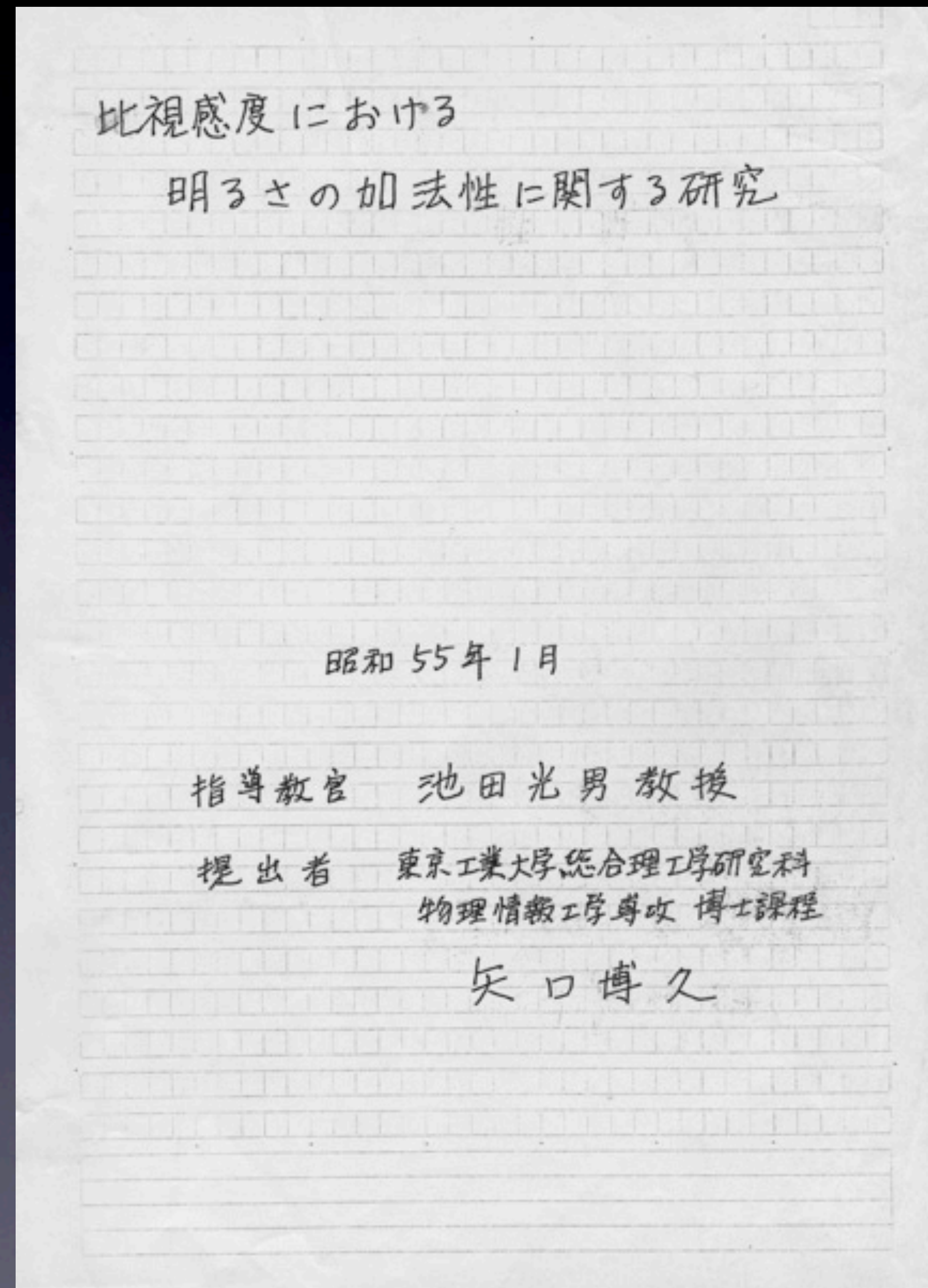
LIGHT AS A TRUE VISUAL QUANTITY : PRINCIPLES OF MEASUREMENT

Members

Membres

Mitglieder

E. MEYER	Afrique du Sud
W. ADRIAN	Allemagne
J. KINGSLEY	Australie
G. VERRIEST	Belgique
V. GAVRIISKI	Bulgarie
P. KAISER	Canada
E. KROGH	Danemark
M. AGUILAR	Espagne
J. KINNEY	Etats-Unis
P. LEHTINEN	Finlande
F. PARRA	France
D. PALMER	Grande-Bretagne
J. SCHANDA	Hongrie
A. TCHETCHIK	Israël
L. RONCHI	Italie
M. IKEDA	Japon
E. ALNAES	Norvège
J. ROUFS	Pays-Bas
S. KONARSKI	Pologne
A. IONESCU	Roumanie
T. KRAKAU	Suède
F. FANKHAUSER	Suisse
J. JOHN	Tchécoslovaquie
D. GLIGO	Yougoslavie



比視感度における
明るさの加法性に関する研究

昭和55年1月

指導教官　池田光男 教授

提出者　東京工業大学総合理工学研究科
物理情報工学専攻 博士課程
矢口博久

NRC (N ... anada)

RESEARCH ASSOCI

The National Research Council o
ciateships tenable in its laboratories. Th
to give promising scientists and engin
challenging research problems in field
the development of their research care
level. There are approximately 160 posit
of them would be available this year.

QUALIFICAT

Applicants should recently have ac

Optics

Basic stan
photometry
vision, the
materials a
given to ap
of photome
metry (colo

$23,000.

The initial appointment will normally
be renewed, subject to the Associate's
requirements of the Division. Renewal
term as a Research Associate will vary b
years.

An appointment may be taken up at
in which the offer is made, but preferab

TRAVEL

An allowance will be provided tow
Research Associate and spouse.

National Research Council Canada — Conseil national de recherches Canada

Division of Physics — Division de physique

File Référence

1 April 1982

Dr. Hirohisa Yaguchi
Department of Information Processing
Tokyo Institute of Technology
Nagatsuta, Midori-ku, Yokohama 227
Japan

Dear Dr. Yaguchi:

We are happy to learn of the success of your candidature for a Research Associateship. I hope that you are able to accept this position, in which case we will look forward to your working here with Dr. G. Wyszecki late this year.

You will note that the offer from the Personnel Services Branch is for a two year tenure. Although the publicity material states a maximum tenure of five years, I should point out that renewals are not automatic but are dependent on the requirements of the Divison and individual performance. The period of tenure in the Division is normally either two or three years; it is extended beyond that only in quite exceptional circumstances.

Yours sincerely,

for H. Preston-Thomas
Associate Director

HTP/sp

Ottawa, Canada
K1A 0R6
Telex 053-4322

---

on thermometry; thermometric
ies; oceanographic measure-
ductivity, plankton, and baro-

oratory of the Fermi National
ction studies at TRIUMF and
University; emulsion studies of

ear infrared),
arch in color
photographic
erence will be
ental aspects
) and colori-

nd applied research in color
s of optical and photographic
t few years, preference will be
g on the fundamental aspects
htness matching) and colori-
nation).

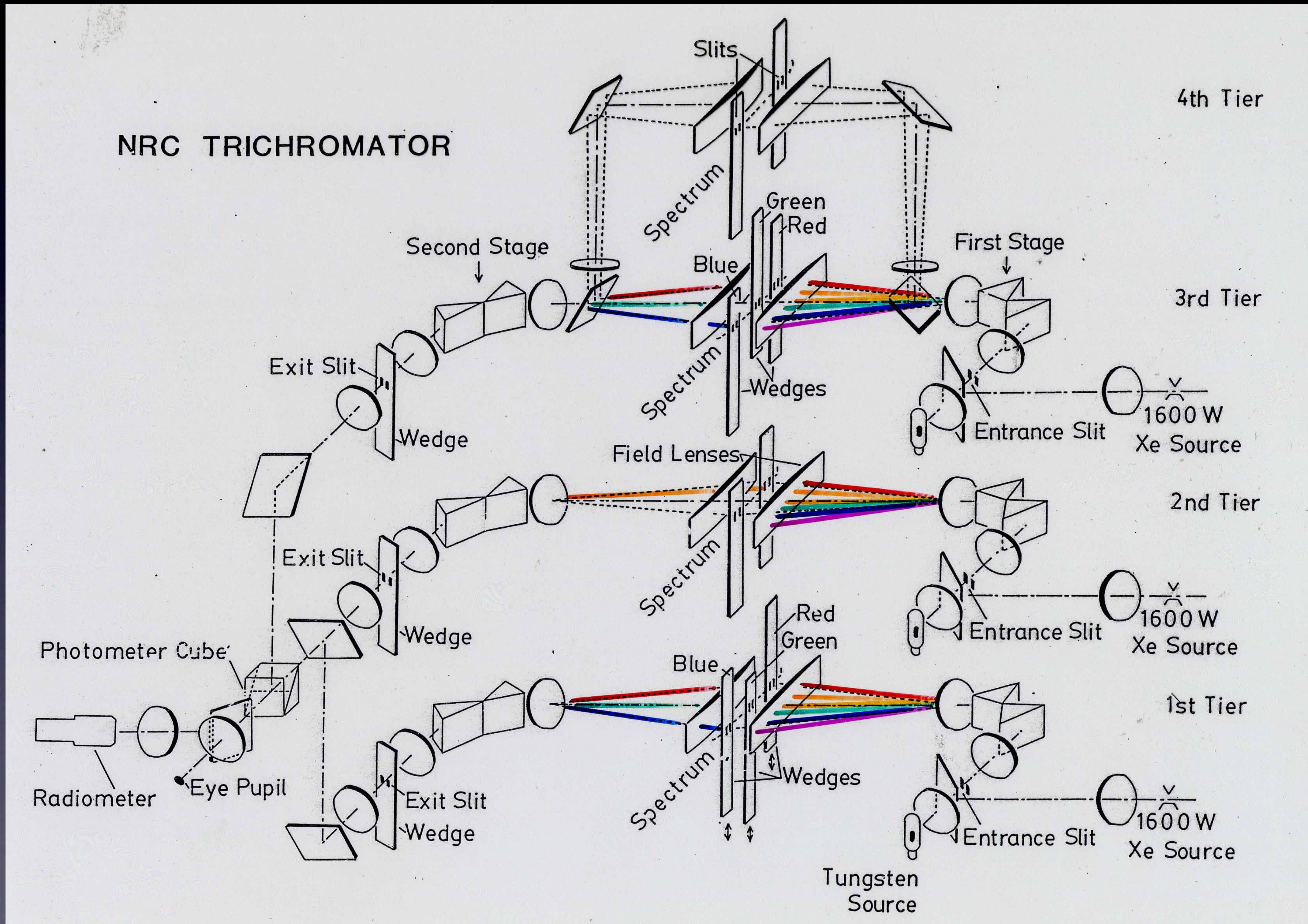
hnology for photogrammetric
ods and software for off-line
; research into factors limiting
graphic applications of photo-
el experiments, space shuttle
nd mapping; investigation of

e metals; electronic structure
intermetallic compounds and

2011年 9月 26日 月曜日

Wyszecki学校の同窓会（熱海にて，1987年頃）

NRC Trichrometer



2011年 9月 26日 月曜日

NRCでの研究(1)

DIE FARBE 34 (1987)

Hirohisa Yaguchi*, CHIBA (Japan):

Signal Transformations from the Cone Stage to the Neural Coding Stage

DK 612.843.313.3

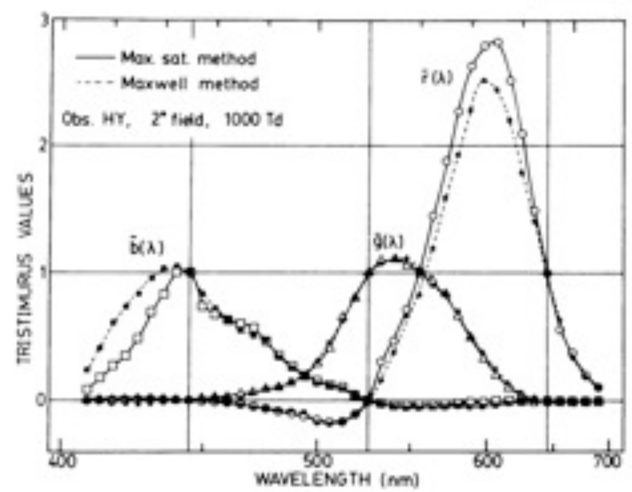


Fig. 2: Color matching functions obtained by the maximum saturation method (open symbols) and by the MAXWELL method (solid symbols)

1. Introduction

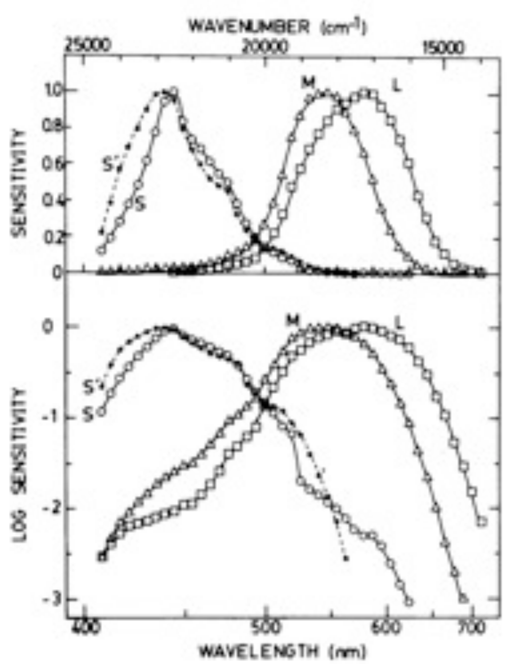


Fig. 3: Cone-sensitivity functions $S(\lambda)$, $M(\lambda)$ and $L(\lambda)$ derived from the linear combination of color matching functions obtained by the maximum saturation method. Cone sensitivity function $S'(\lambda)$ is derived from the linear combination of the MAXWELL color matching functions

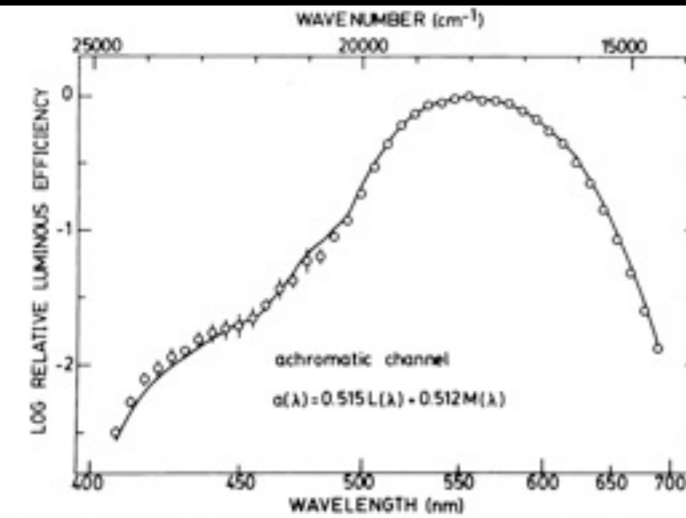


Fig. 4: Luminous efficiency function measured by the flicker photometry. Open circles sh

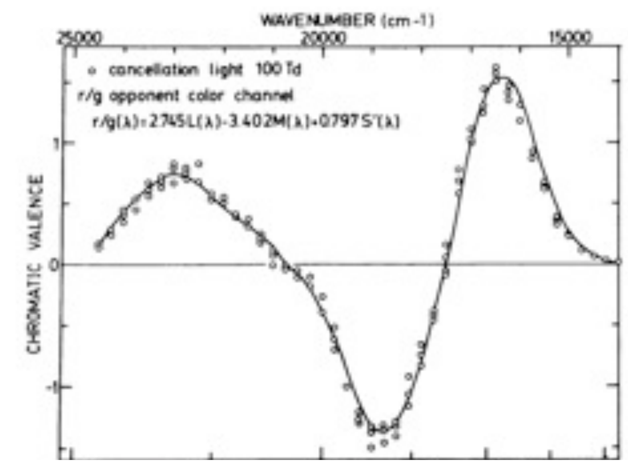


Fig. 5: T
cellatio
oppone

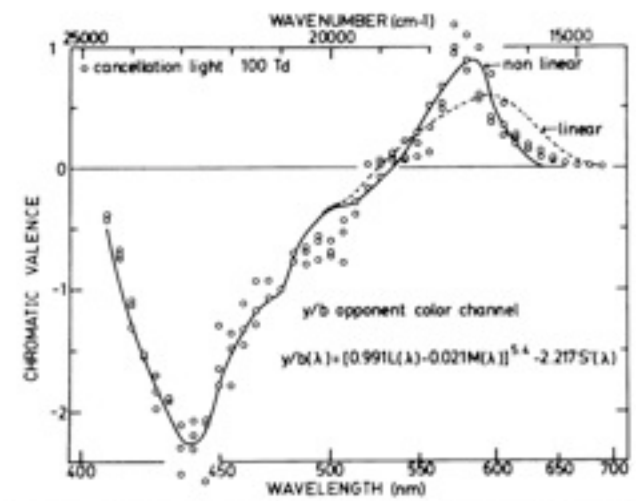
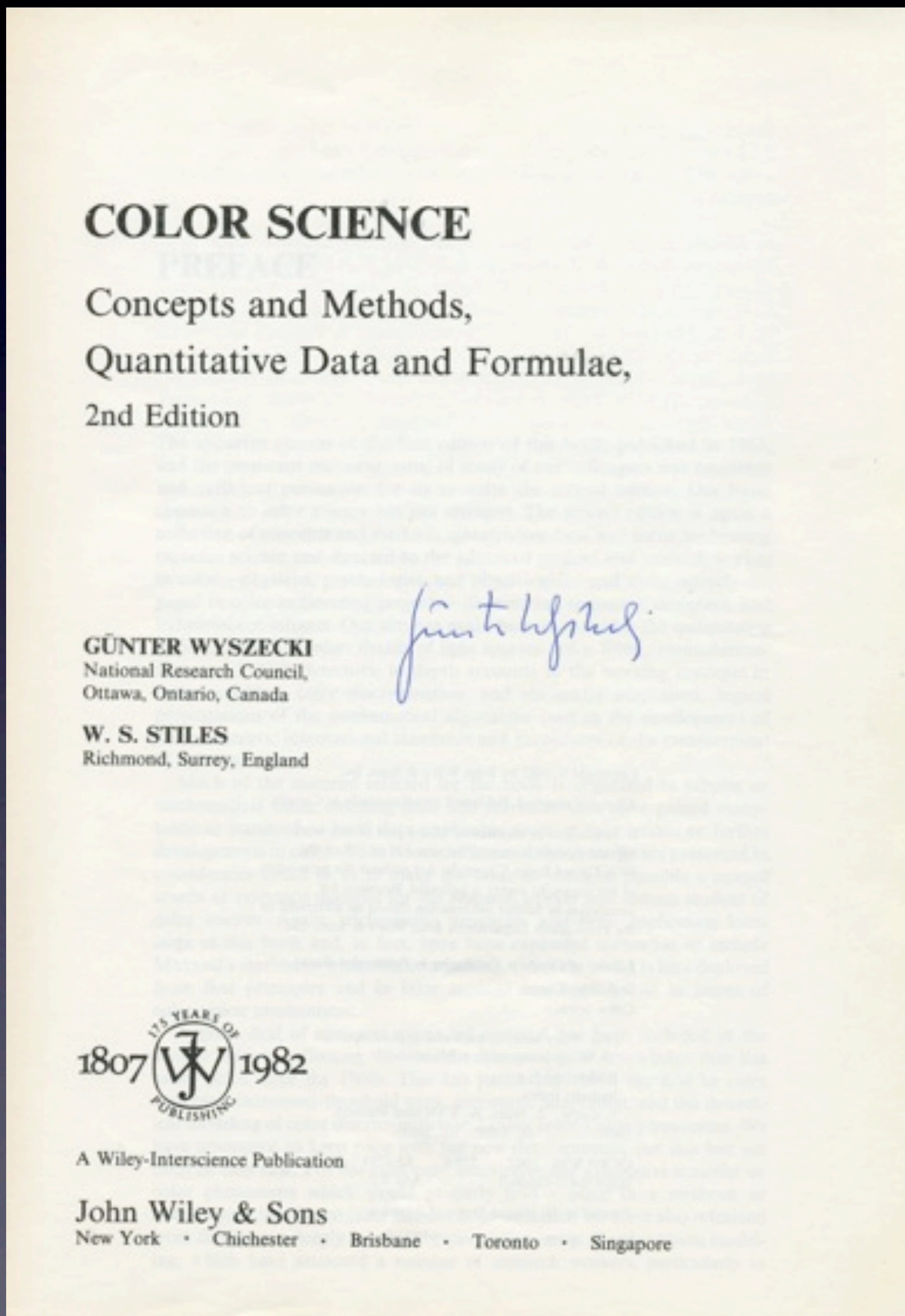


Fig. 6: The yellow-blue opponent-color response function measured by the hue cancellation method. Open circles show the experimental data, a dashed curve is predicted by the linear transformation model, and a solid curve is predicted by the non-linear transformation model

Wyszecki and Stiles Memorial Symposium on Color Vision Models, Firenze, 1987



COLOR SCIENCE

Concepts and Methods,
Quantitative Data and Formulae,
2nd Edition

GÜNTER WYSZECKI
National Research Council,
Ottawa, Ontario, Canada

W. S. STILES
Richmond, Surrey, England

1807 175 YEARS OF PUBLISHING 1982

A Wiley-Interscience Publication

John Wiley & Sons
New York · Chichester · Brisbane · Toronto · Singapore

WALTER STANLEY STILES
* 15. 6. 1901
† 15. 12. 1985

GÜNTER WYSZECKI
* 8. 11. 1925
† 22. 6. 1985

納谷先生とDr. Hunt (1987)

Y. Nayatani

Cone resp
two kinds c
luminance c
The effective
cal experime
has a specia

Die im Fa
tionen setze
entspricht d
betrachteter
wird durch
über die bere
chaft, die es

Le modèle
certaines ré
première rer
couleur d'ob
tats de beau
de l'apparen
Retinex de L

O. Estévez: Summary of the Florence Meeting

In the second part of the session, AKITA presented his results on opponency using the cancellation method. He agreed that red/green opponency can be thought of as a linear transformation while yellow/blue

34 (1987)

ce

59.937.51
35.646
12.843.31

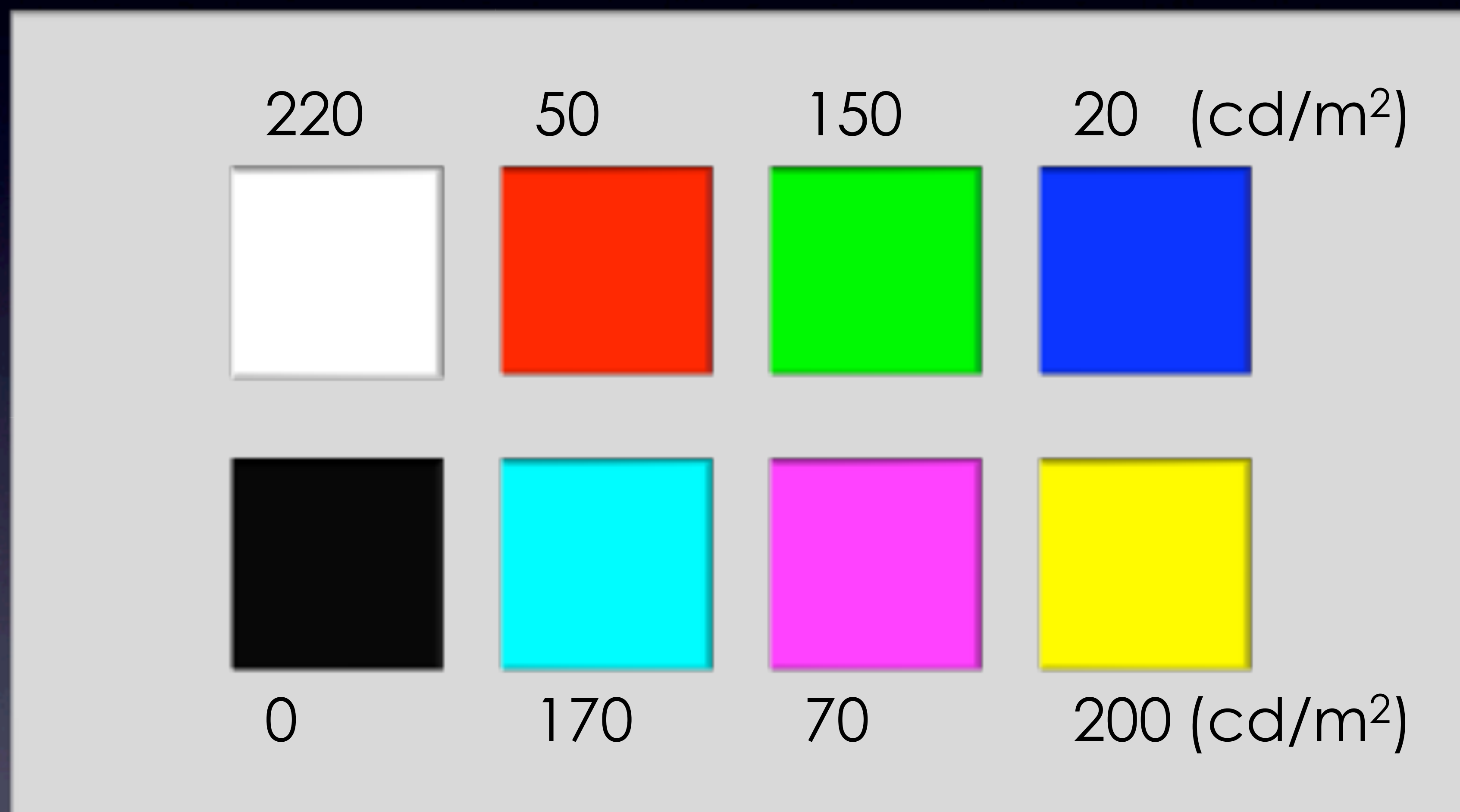
ovide pre-
na, for sti-
iance and
uction by

wird hier
igung und
Umfeldern
ch Fakto-
contrastes

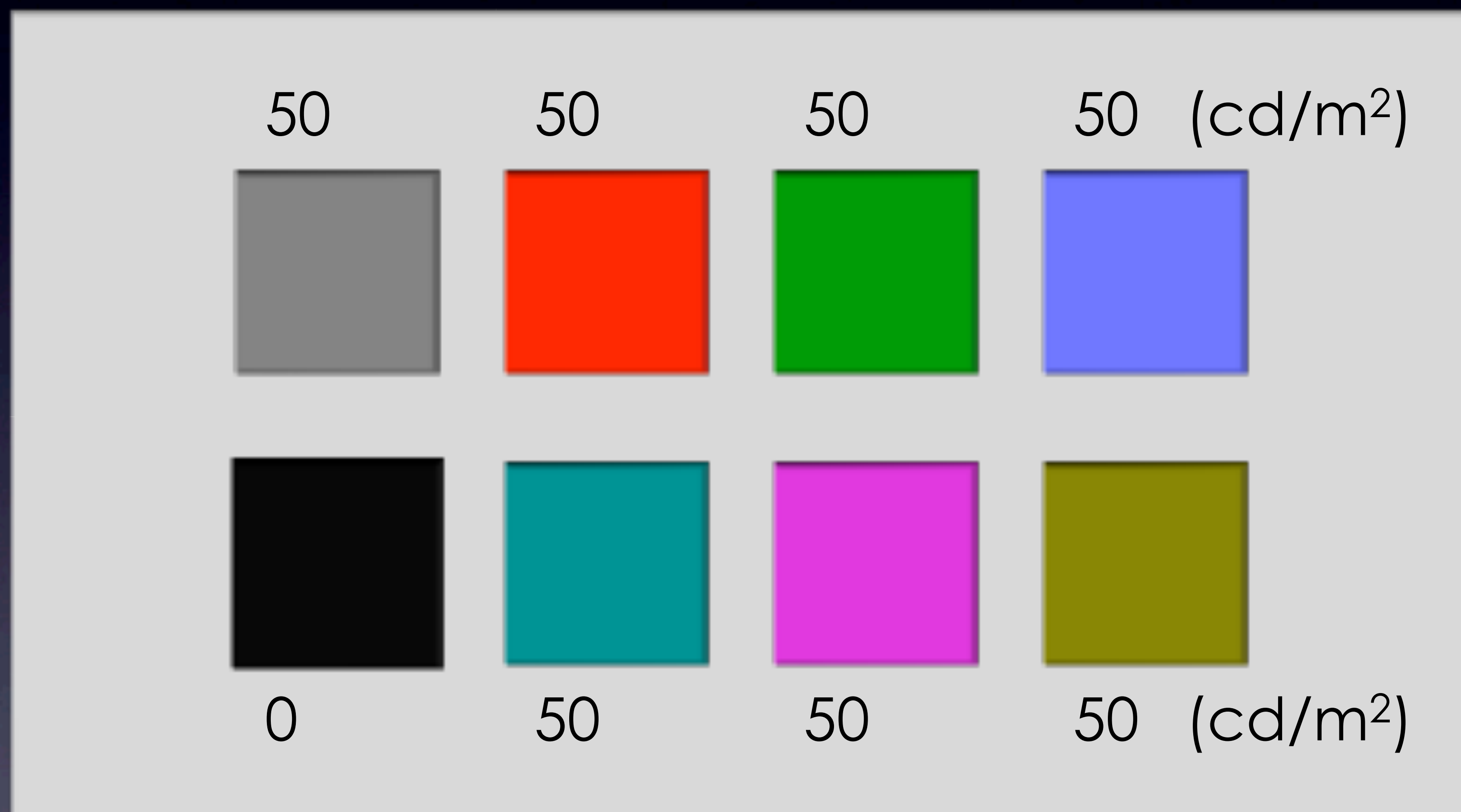
fois est ici
té, satura-
si l'on les
aussi on a
incorporé des facteurs qui tiennent compte de l'effet Judd-Helson et du contraste simultané

会場となったフィレンツェの光学研究所にて

輝度に対応した明るさに見えますか？



Helmholtz-Kohlrausch効果



なぜ輝度と明るさが一致しないのか？

- 輝度の定義

$$L = K_{\mathrm{m}} \int_{\lambda} L_{e,\lambda} V(\lambda) d\lambda$$

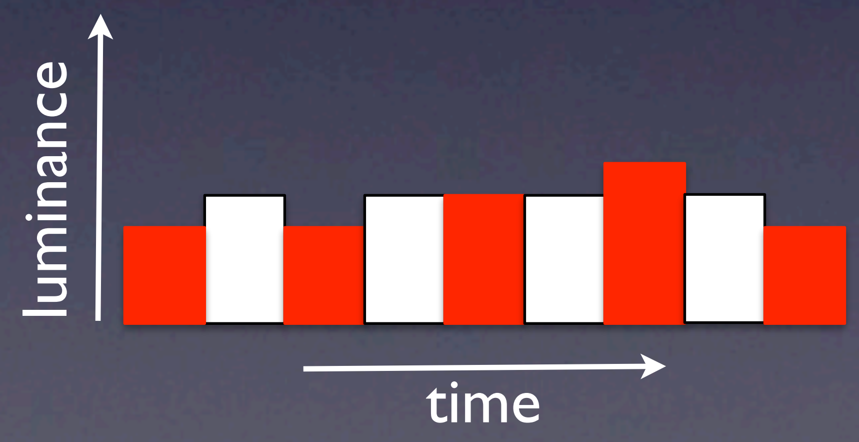
加法則，Abney's law

- (a) *V*(λ)がおかしい？
- (b) 明るさの加法則が成立しない？
- (c) (a)と(b)の両方の可能性？

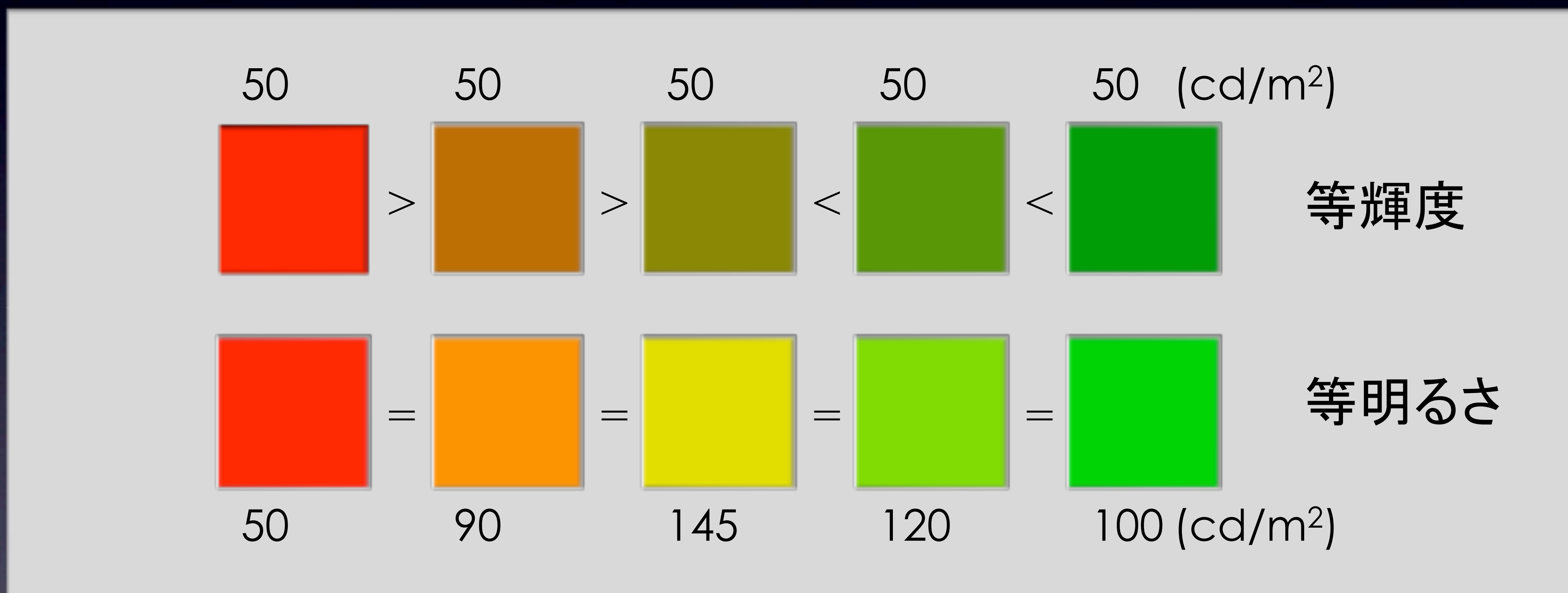
直接比較法と交照法

Heterochromatic Brightness Matching

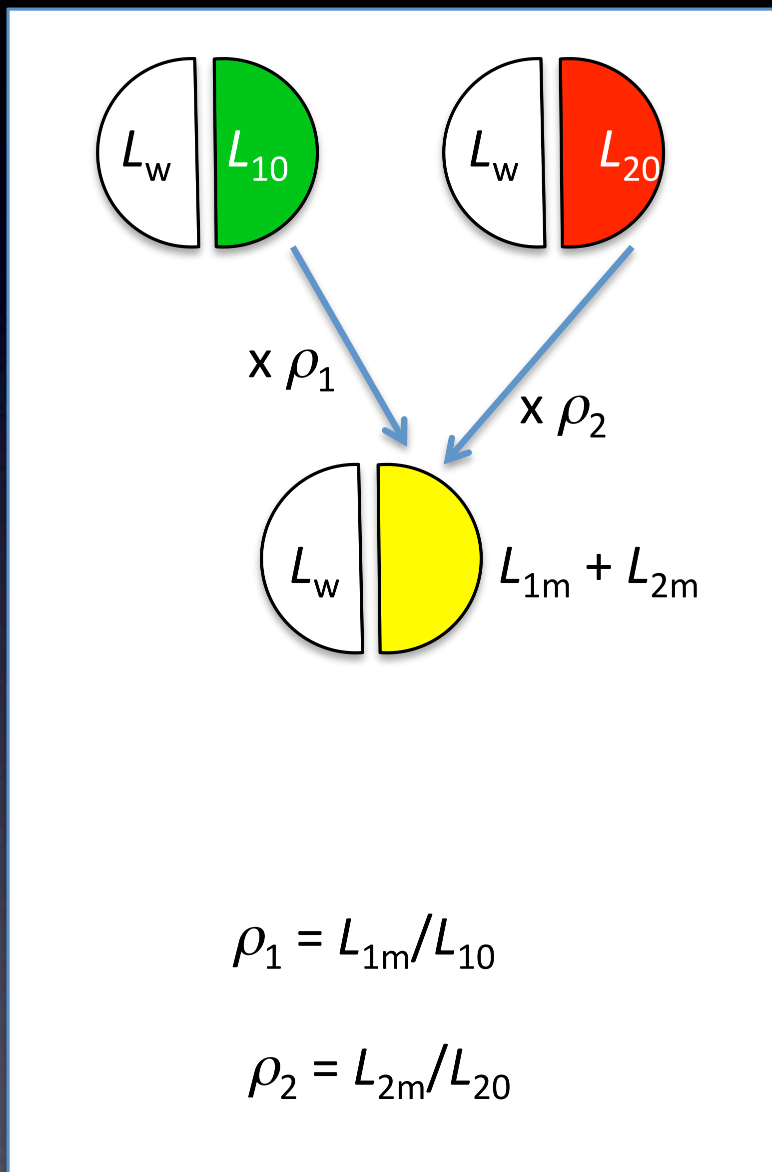
Flicker Photometry



明るさの加法則は成立するか？

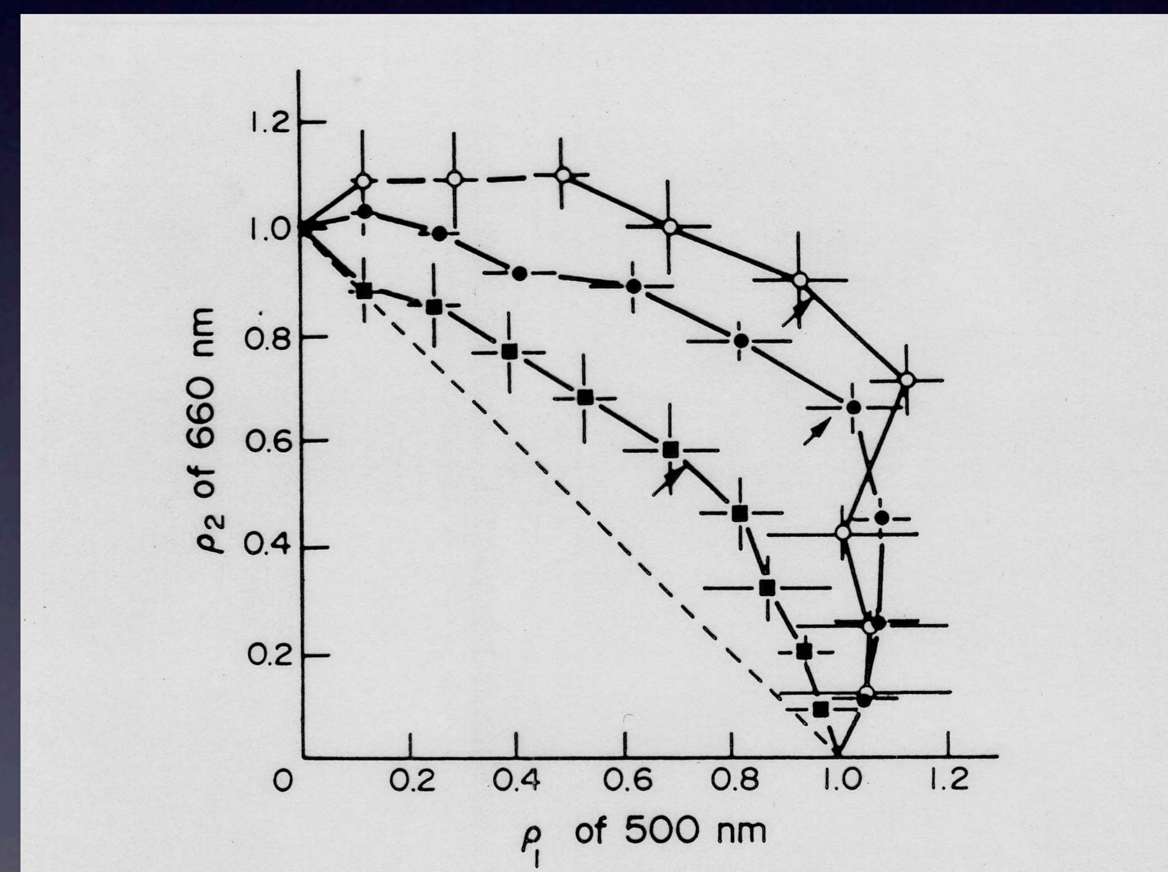


明るさの加法則不軌



500nmと660nmの単色光の混色による加法則不軌

(Yaguchi et al., Vision Res., 1983)



$\rho_1+\rho_2=1$; additivity

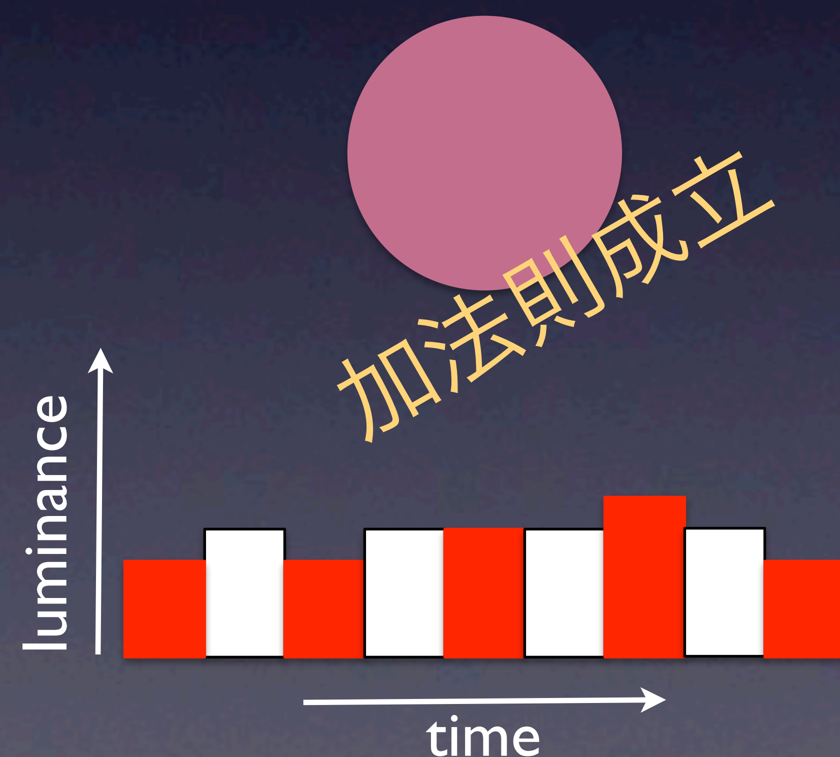
$\rho_1+\rho_2>1$; subadditivity

$\rho_1+\rho_2<1$; superadditivity

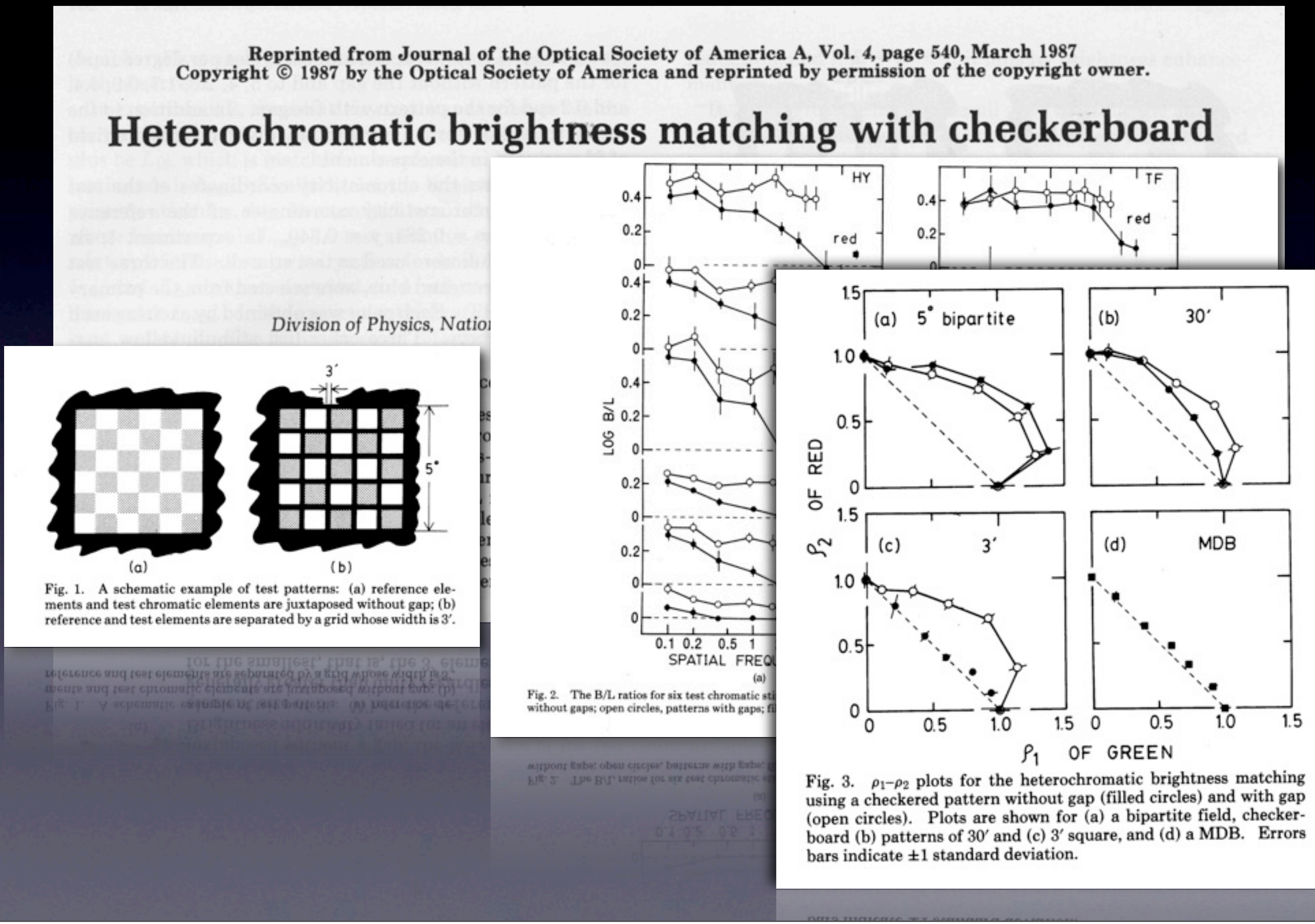
直接比較法と交照法

Heterochromatic Brightness Matching

Flicker Photometry



NRCでの研究(2)



Reprinted from Journal of the Optical Society of America A, Vol. 4, page 540, March 1987
Copyright © 1987 by the Optical Society of America and reprinted by permission of the copyright owner.

Heterochromatic brightness matching with checkerboard

Division of Physics, Natio

Fig. 1. A schematic example of test patterns: (a) reference elements and test chromatic elements are juxtaposed without gap; (b) reference and test elements are separated by a grid whose width is 3′.

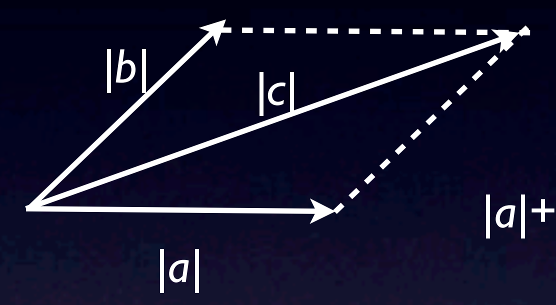
Fig. 2. The B/L ratios for six test chromatic sti... without gaps; open circles, patterns with gaps; fi...

Fig. 3. ρ_1–ρ_2 plots for the heterochromatic brightness matching using a checkered pattern without gap (filled circles) and with gap (open circles). Plots are shown for (a) a bipartite field, checkerboard (b) patterns of 30′ and (c) 3′ square, and (d) a MDB. Errors bars indicate ±1 standard deviation.

加法則不軌の原因

明るさのメカニズム

- Subadditivity
  - Guth's vector summation model
  - $A^2+T^2+D^2=1$



- Subadditivity and superadditivity
  - Yaguchi's nonlinear summation model
  - $A^2+C_1^{2p}+C_2^{2q}=1$

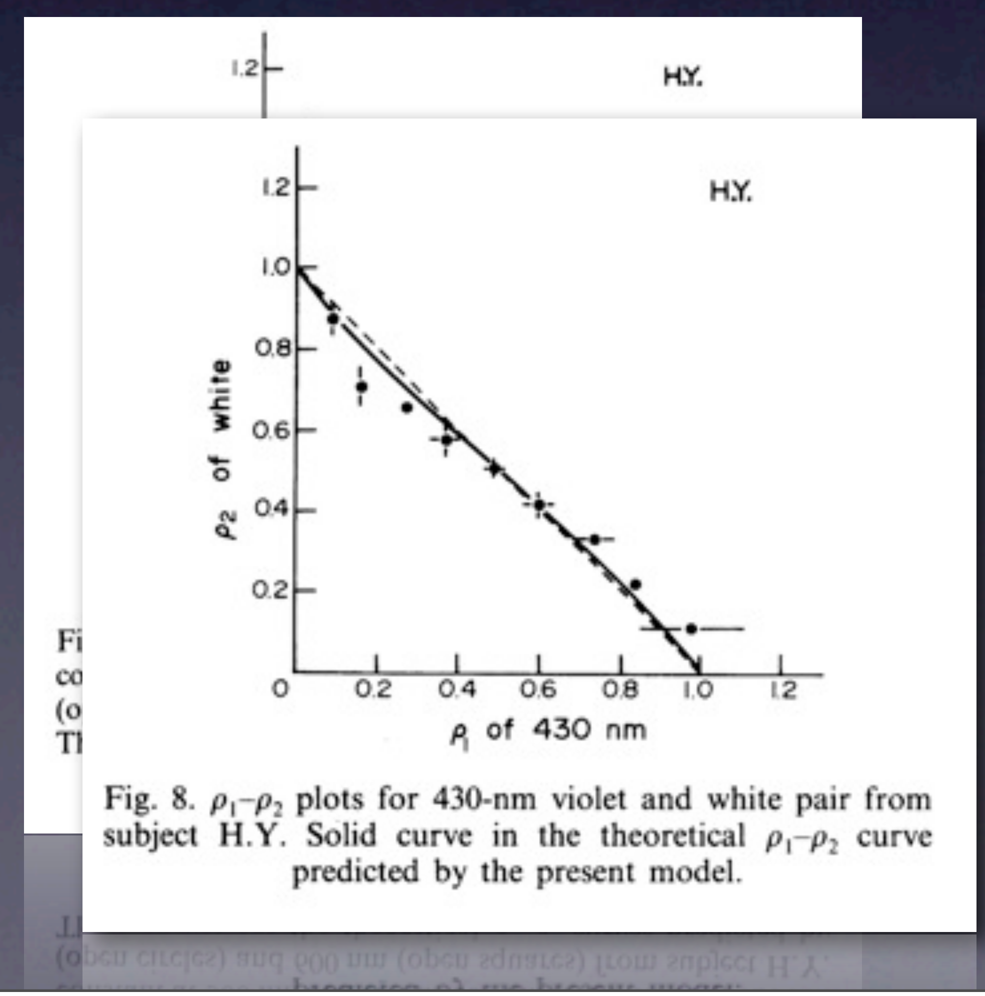


Fig. 8. ρ_1–ρ_2 plots for 430-nm violet and white pair from subject H.Y. Solid curve in the theoretical ρ_1–ρ_2 curve predicted by the present model.

納谷先生の加法則不軌の予測

COLOR research and application
Volume 25, Number 1, February 2000

of Experimental

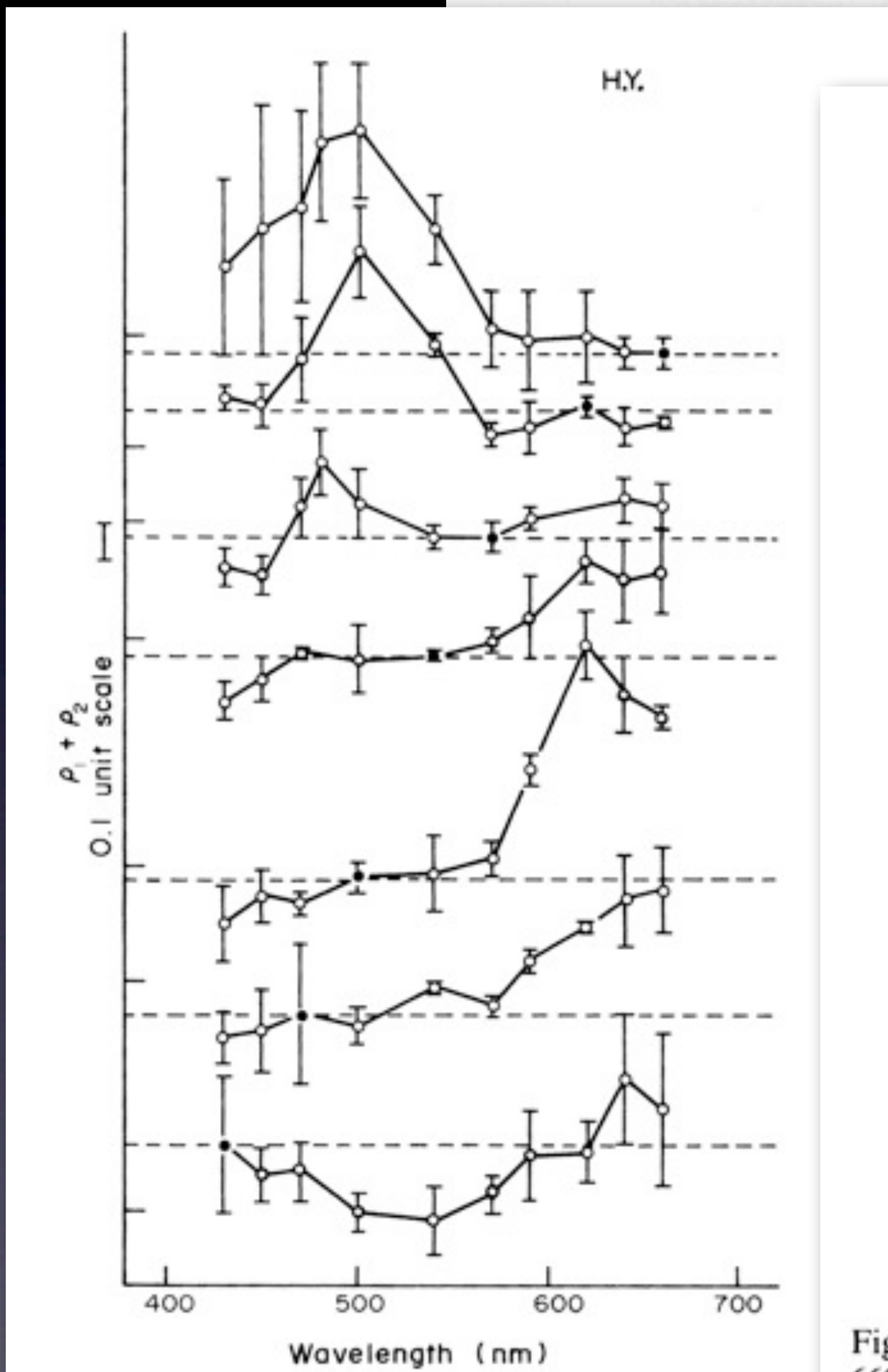


Fig. 2. $\rho_1 + \rho_2$ for seven different λ_1, 430, 470, 500, 540, 570, 620 and 660 nm from subject H.Y. Each solid circle indicates a certain λ_1.

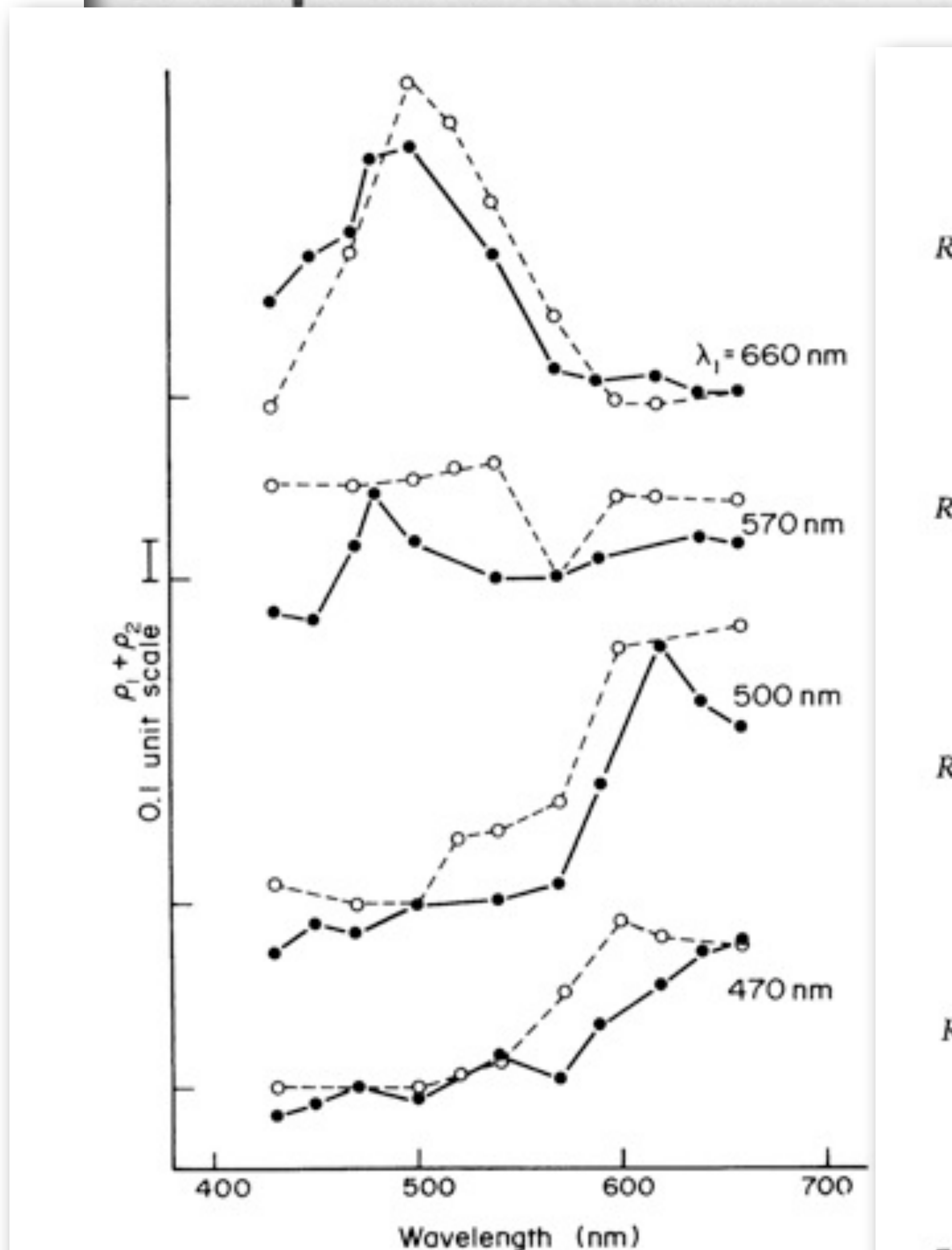


Fig. 10. $\rho_1 + \rho_2$ for four different λ_1, 470, 500, 570
660 nm for subject H.Y. Solid circles are the experimer
results same as Fig. 2, open circles are the theoretical poi

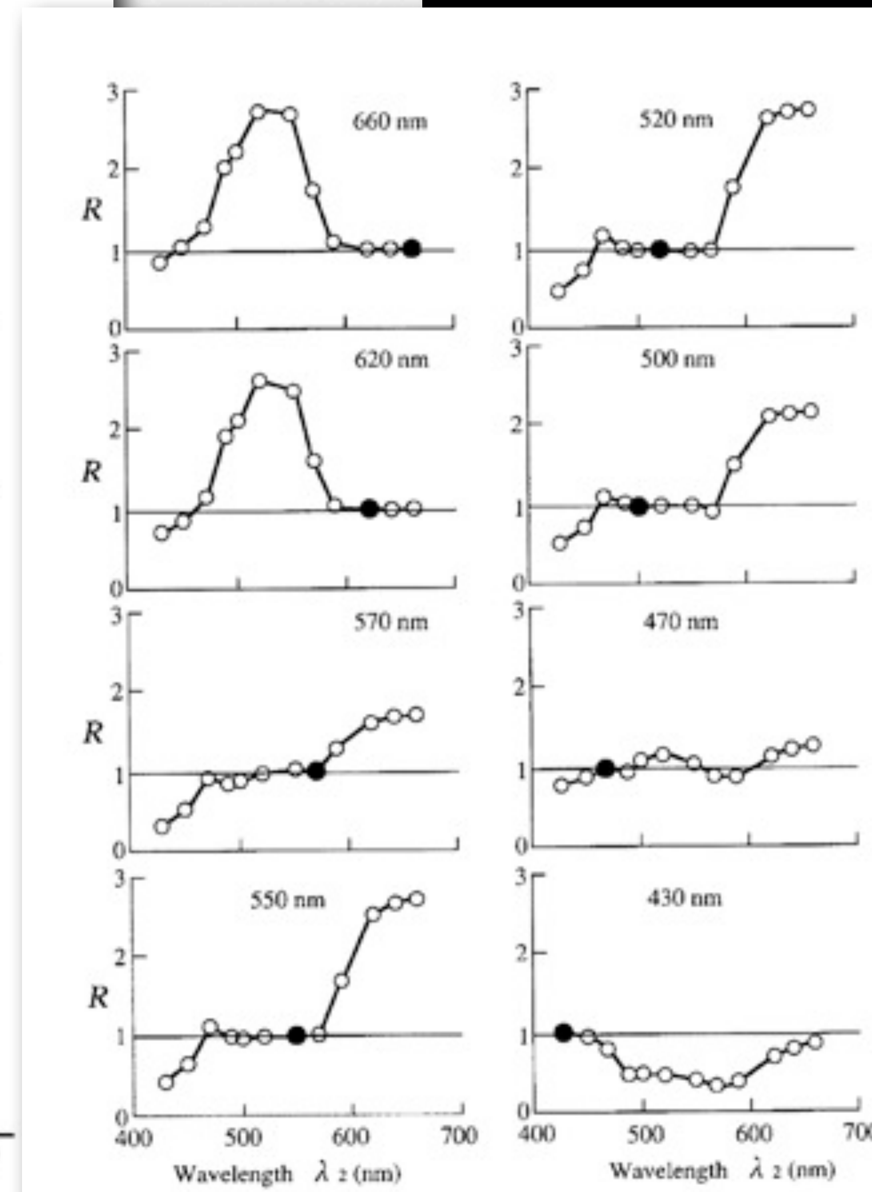
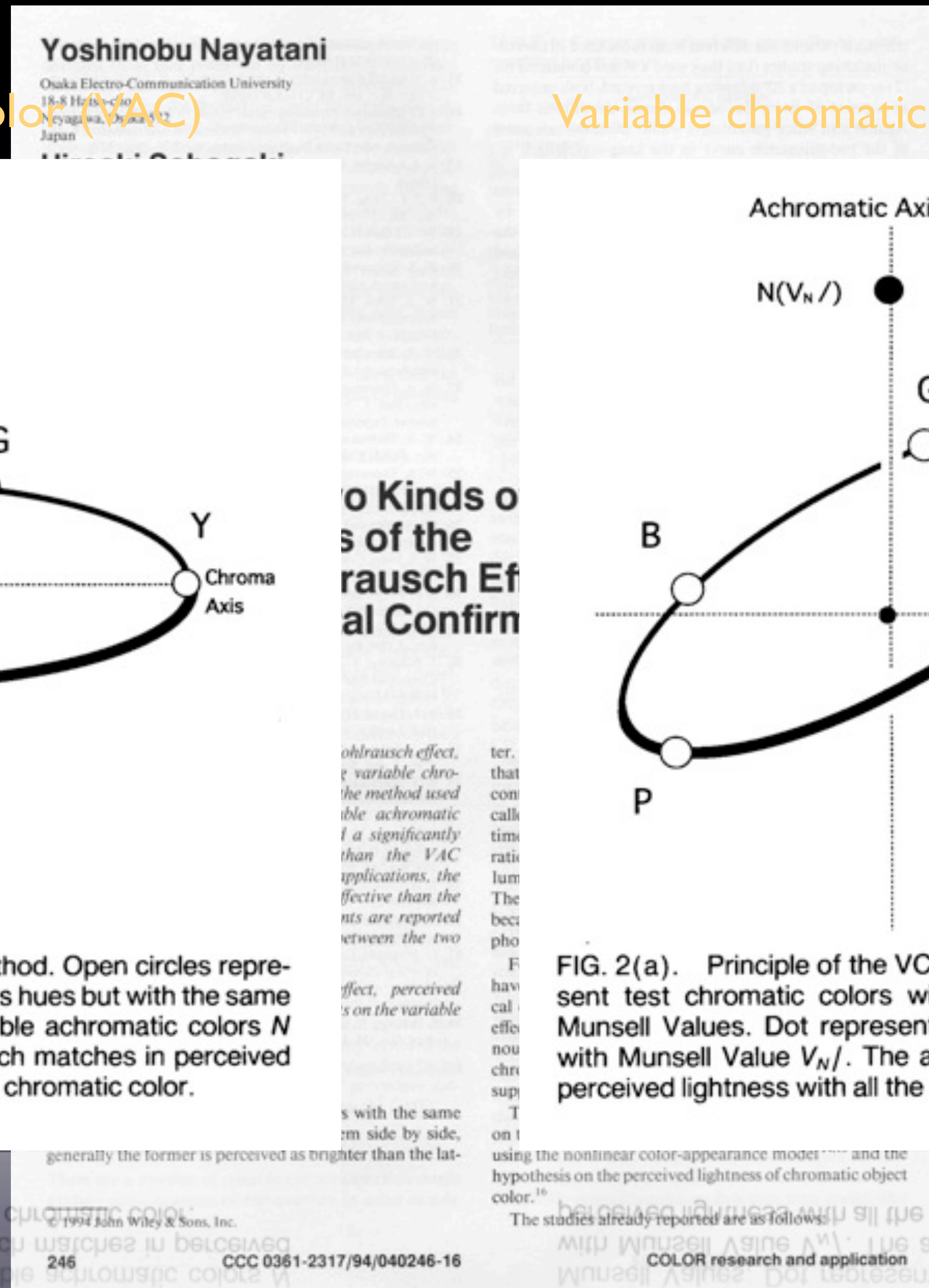


FIG. 2. The values R predicted by the present study corresponding to Fig. 1. Seven wavelengths λ_1 are used, which are 660, 620, 570, 550, 520, 470, and 430 nm from the left top to right bottom. For other information, see the caption of Fig. 1.

VACとVCC (1)



Variable achromatic color (VAC)

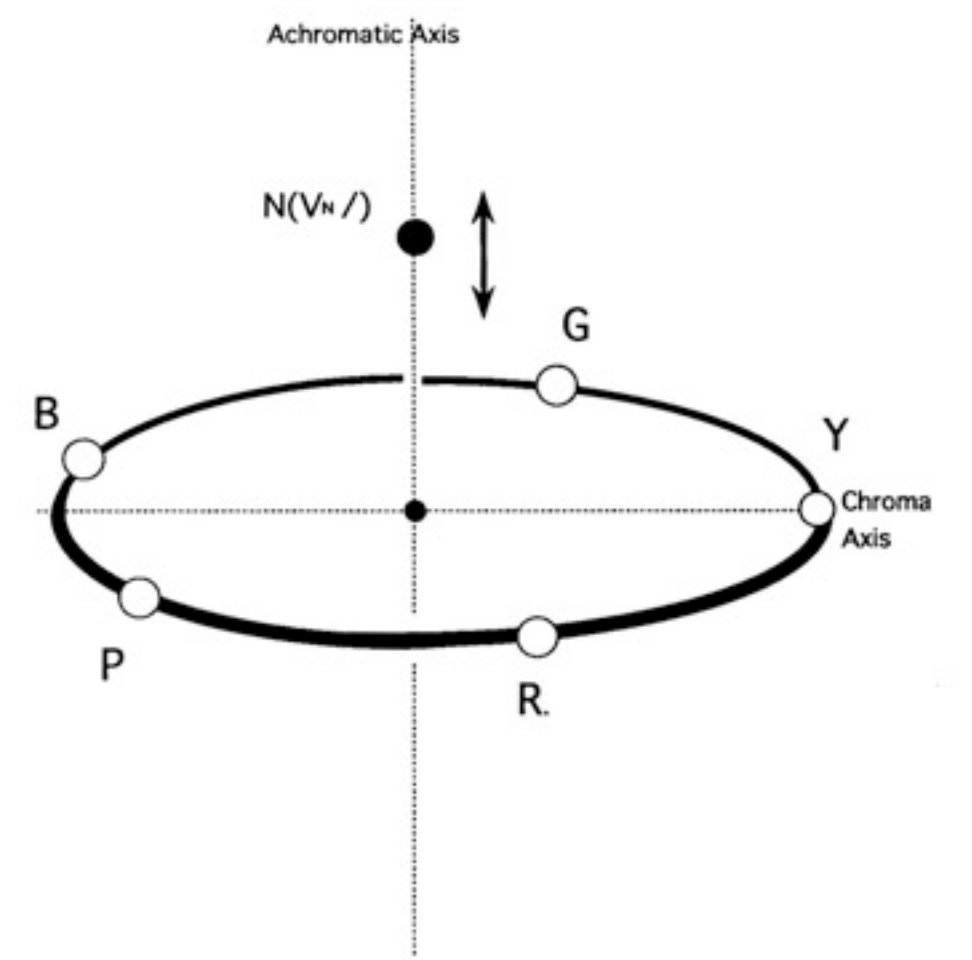


FIG. 1(a). Principle of the VAC method. Open circles represent test chromatic colors with various hues but with the same Munsell Value. Dot represents variable achromatic colors *N* with Munsell Value $V_N/$, each of which matches in perceived lightness with the corresponding test chromatic color.

Variable chromatic color (VCC)

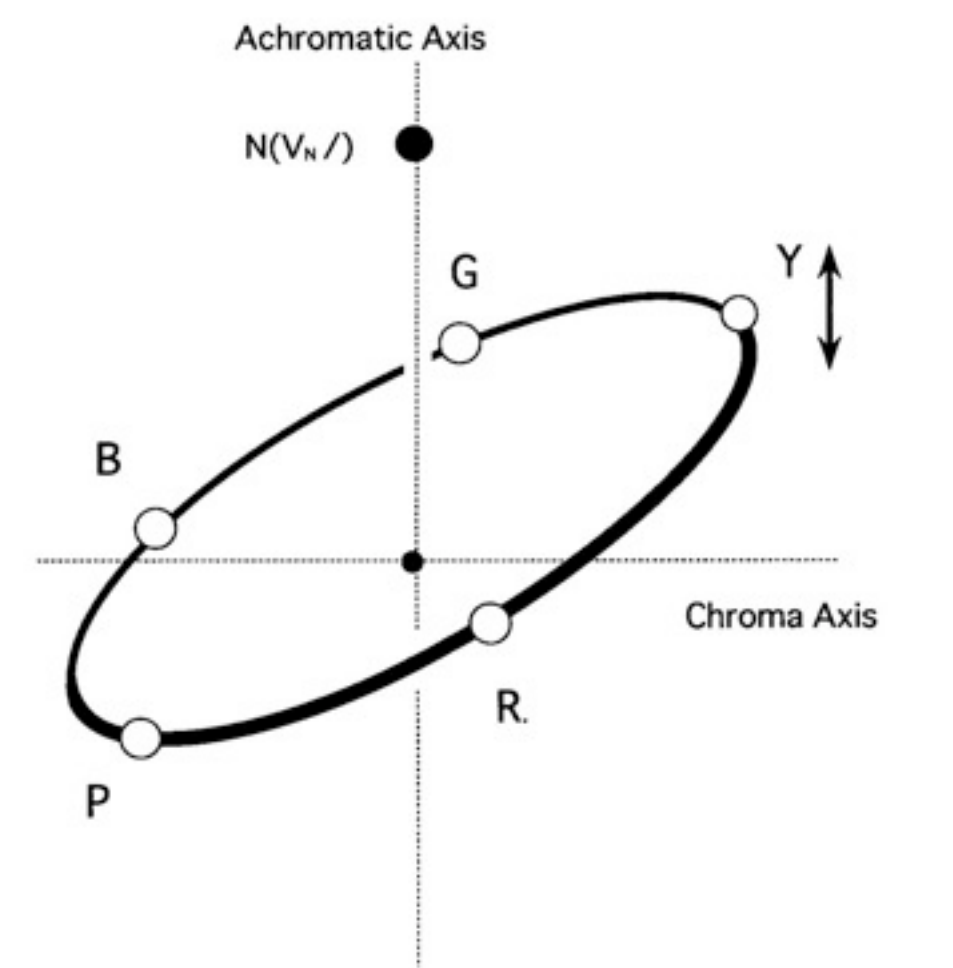


FIG. 2(a). Principle of the VCC method. Open circles represent test chromatic colors with various hues and various Munsell Values. Dot represents a fixed achromatic color *N* with Munsell Value $V_N/$. The achromatic color *N* matches in perceived lightness with all the test chromatic colors.

VACとVCC (2)

Relations between the Two Kinds of Representation Methods in the Helmholtz–Kohlrausch Effect

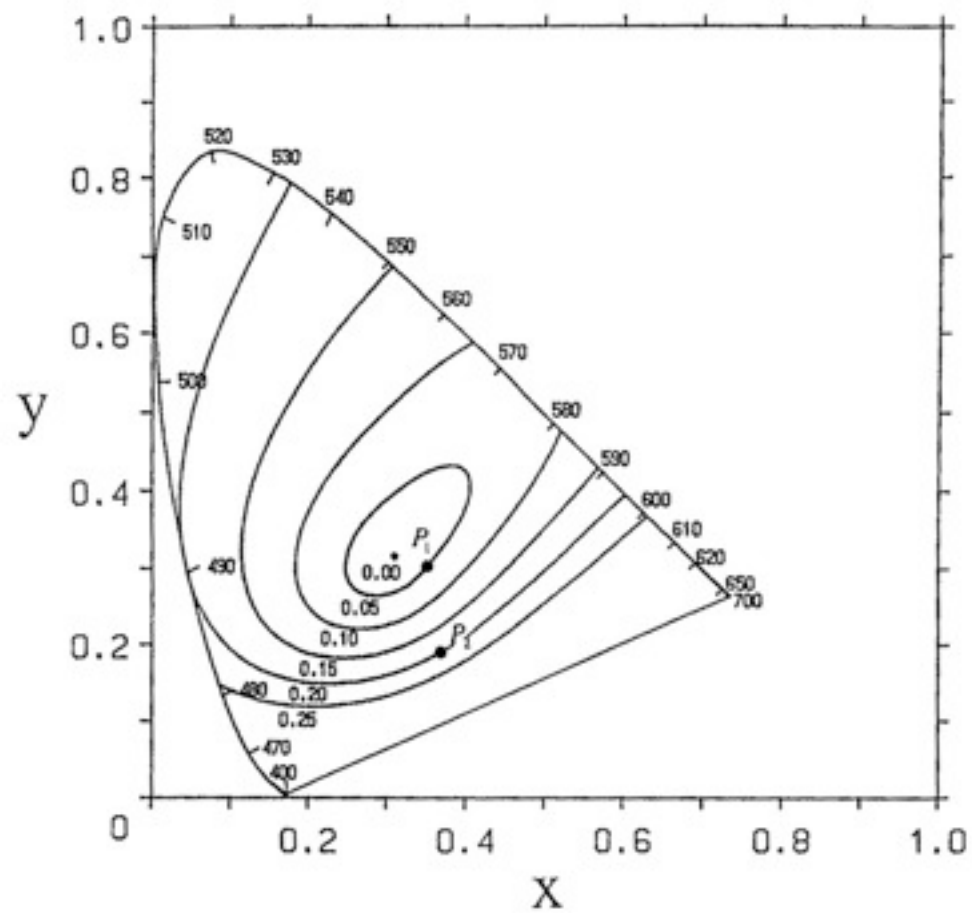


FIG. 1. Loci with constant values of $\log_{10}L_N/L$ in the VAC method, where the test luminance L is kept at 63.66 cd/m^2 constant. Chromatic color P_1 corresponds to $\log_{10}Y_N/Y = 0.05$, and P_2 to $\log_{10}Y_N/Y = 0.20$.

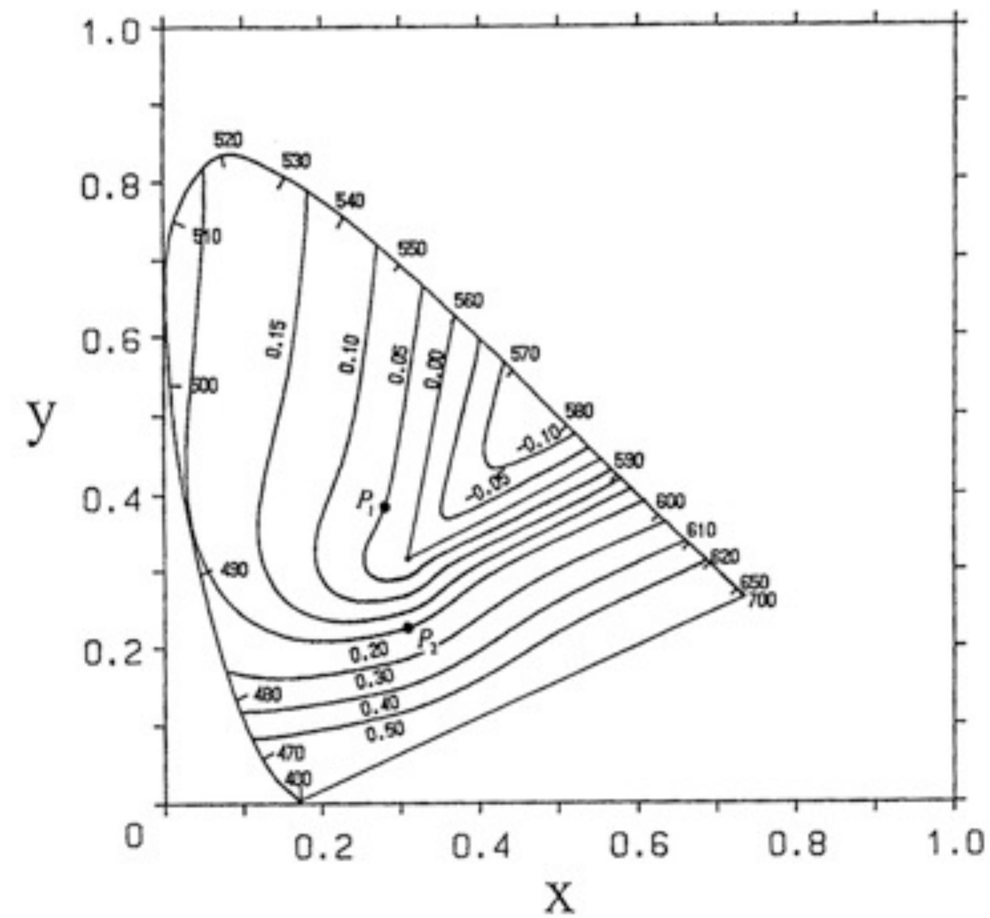
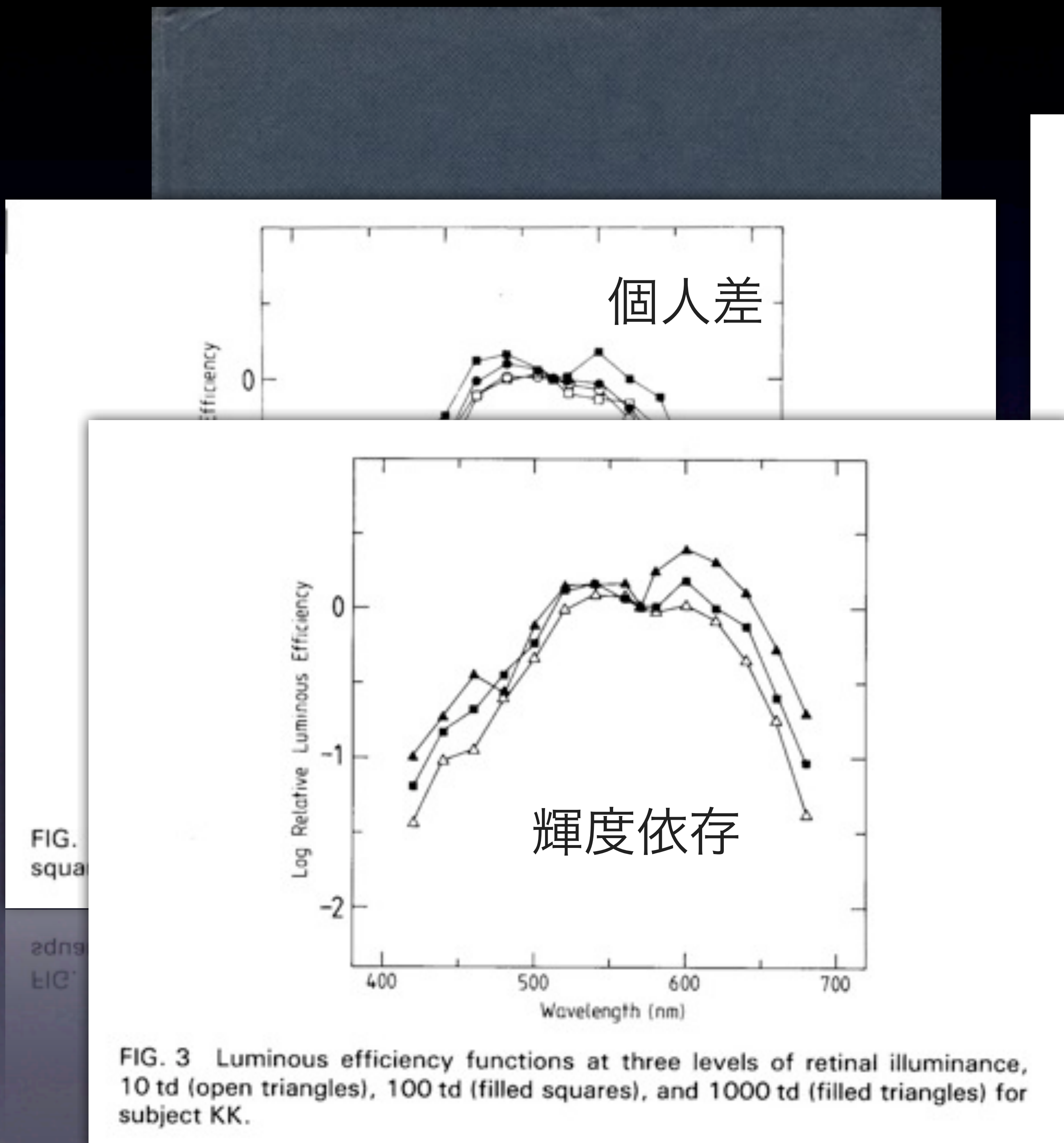
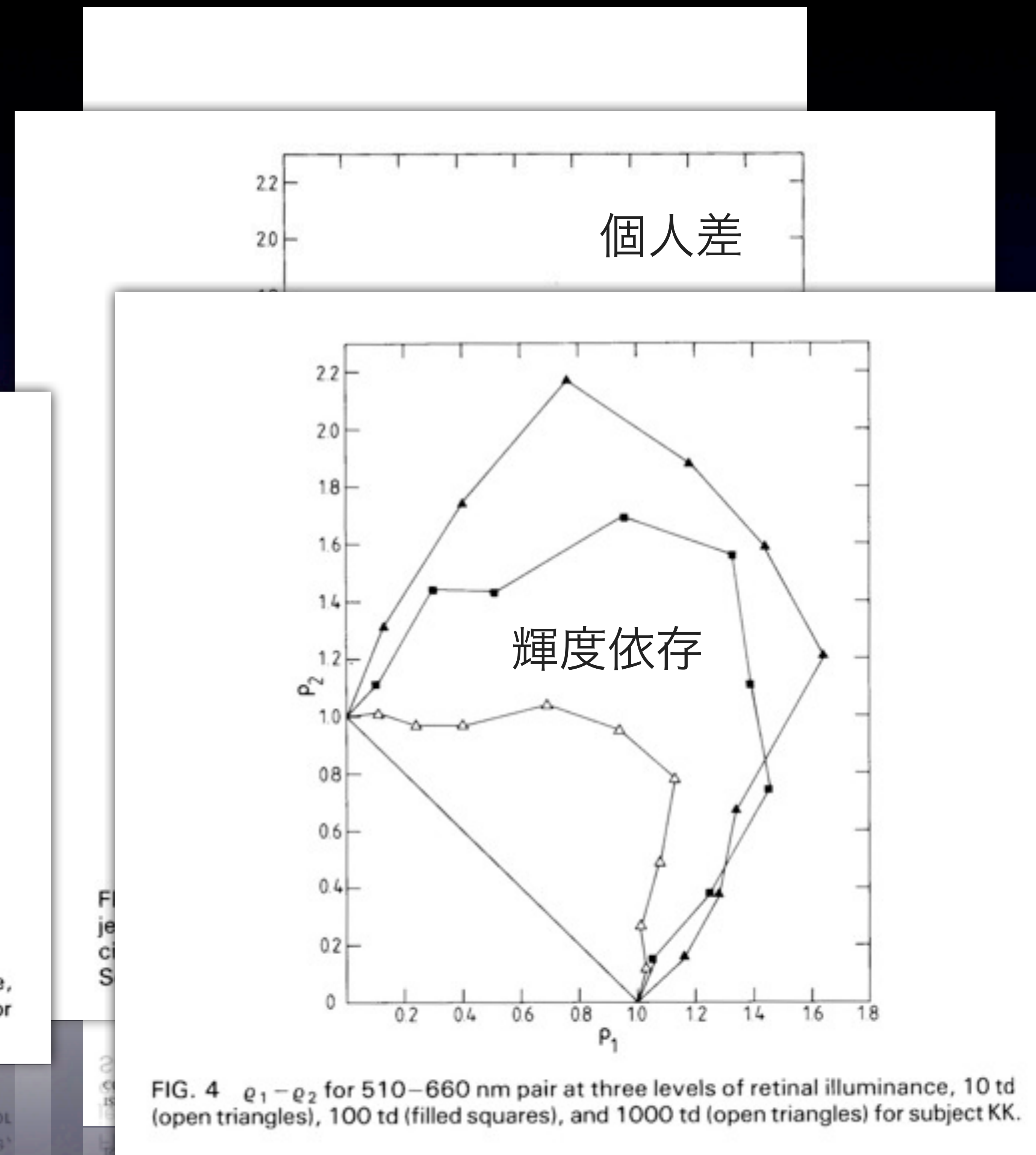


FIG. 2. Loci with constant values of $\log_{10}L_N/L$ in the VCC method, where the equivalent luminance L_N is kept at 63.66 cd/m^2 constant. Chromatic color P_1 corresponds to $\log_{10}Y_N/Y = 0.05$, and P_2 to $\log_{10}Y_N/Y = 0.20$.

288 CCC 0361-2317/98/050288-14 COLOR research and application

H-K効果の個人差と輝度依存性





矢口君,
君の研究は未だ甘い！

ウフィチ美術館前にて，1987.6.12