

Package: CVD (via r-universe)

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Type Package

Title Color Vision Deficiencies

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Description Methods for color vision deficiencies (CVD), to help understanding and mitigating issues with CVDs and to generate tests for diagnosis and interpretation.

License GPL (>= 3)

Depends R (>= 2.10)

Enhances png, gWidgets2, RGtk2

LazyData yes

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`approx.scotopic.luminance.LarsonEtAl.RGB`

Approximation of the scotopic luminance

Description

`approx.scotopic.luminance.LarsonEtAl.RGB` approximates the scotopic luminance from RGB values. `approx.scotopic.luminance.LarsonEtAl.XYZ` approximates the scotopic luminance from XYZ values.

Usage

`approx.scotopic.luminance.LarsonEtAl.XYZ(XYZmatrix)`
`approx.scotopic.luminance.LarsonEtAl.RGB(RGBmatrix)`

Arguments

<code>XYZmatrix</code>	matrix with XYZ values
<code>RGBmatrix</code>	matrix with RGB values

Value

approximated scotopic luminance

Author(s)

Jose Gama

Source

Larson, G. W., H. Rushmeier, and C. Piatko (1997, October - December). A visibility matching tone reproduction operator for high dynamic range scenes. *IEEE Transactions on Visualization and Computer Graphics* 3 (4), 291–306.

References

Larson, G. W., H. Rushmeier, and C. Piatko (1997, October - December). A visibility matching tone reproduction operator for high dynamic range scenes. *IEEE Transactions on Visualization and Computer Graphics* 3 (4), 291–306.

Examples

```
## Not run:
samplePics <- c('fruits', 'pastel_color', 'sample1', 'TurnColorsGrayImage1', 'TurnColorsGrayImage2')
for (pics in samplePics)
{
  fname<-paste(system.file(package='CVD'), '/extdata/', pics, '.png', sep='')
  imgTest<-loadPNG(fname)
  imgTest.array<-approx.scotopic.luminance.LarsonEtAl.RGB.array(imgTest)
  png::writePNG(imgTest.array, paste(pics, '.approx.scotopic.luminance.LarsonEtAl.RGB.png', sep=''))
}

## End(Not run)
```

attenuationNumberOfEyes

Attenuation as a function of number of eyes

Description

attenuationNumberOfEyes computes the attenuation as a function $M(e)$ of number of eyes e (1 or 2), from Watson A. B., Yellott J. I. (2012).

Usage

```
attenuationNumberOfEyes(e)
```

Arguments

e number of eyes (1 or 2)

Value

PupilSize attenuation

Author(s)

Jose Gama

References

Watson A. B., Yellott J. I. (2012). A unified formula for light-adapted pupil size. *Journal of Vision*, 12(10):12, 1–16. <http://journalofvision.org/12/10/12/>, doi:10.1167/5.9.6.

Examples

```
## Not run:
attenuationNumberOfEyes(1)
attenuationNumberOfEyes(2)

## End(Not run)
```

B20

Farnsworth B-20 cap colors

Description

B20 contains the cap colors for the Farnsworth B-20 test, in XYZ coordinates. The Farnsworth B-20 is a short test for detecting congenital color vision deficiencies.

Usage

B20

Format

This data frame contains the following columns:

CapNo Cap Number

Munsell Munsell color

X CIE X cap color

Y CIE Y cap color

Z CIE Z cap color

Author(s)

Jose Gama

Source

Judd, D.B. and MacAdam, D.L., 1979 Contributions to Color Science University of Rochester. Institute of Optics and Center for Building Technology Department of Commerce, National Bureau of Standards

References

Judd, D.B. and MacAdam, D.L., 1979 Contributions to Color Science University of Rochester. Institute of Optics and Center for Building Technology Department of Commerce, National Bureau of Standards

Examples

```
data(B20)
B20
```

BowmanTCDS

Table of color distance scores for quantitative scoring of the Farnsworth panel D-15 test

Description

BowmanTCDS contains the color distance scores for quantitative scoring of the Farnsworth panel D-15 test, from Bowman KJ (1982) The Farnsworth Dichotomous test (D-15) is a short test for detecting congenital color vision deficiencies. Bowman KJ (1982) created a table based on the Commission Internationale de l'Eclairage (International Commission on Illumination, CIE) Space and Color Difference formula, CIE 1976 ($L^*a^*b^*$) with perceptual distances between pairs of caps. The table is used for the calculation of the Total Color Distance Score (TCDS) which is the sum of the CIELAB space distances between colored caps.

Usage

BowmanTCDS

Format

This data frame contains the following columns:

Pilot Distances between colored caps for the pilot cap
Cap1 Distances between colored caps for the 1st cap
Cap2 Distances between colored caps for the 2nd cap
Cap3 Distances between colored caps for the 3rd cap
Cap4 Distances between colored caps for the 4th cap
Cap5 Distances between colored caps for the 5th cap
Cap6 Distances between colored caps for the 6th cap
Cap7 Distances between colored caps for the 7th cap
Cap8 Distances between colored caps for the 8th cap
Cap9 Distances between colored caps for the 9th cap
Cap10 Distances between colored caps for the 10th cap
Cap11 Distances between colored caps for the 11th cap
Cap12 Distances between colored caps for the 12th cap
Cap13 Distances between colored caps for the 13th cap
Cap14 Distances between colored caps for the 14th cap
Cap15 Distances between colored caps for the 15th cap

Author(s)

Jose Gama

Source

Bowman KJ: A method for quantitative scoring of the Farnsworth panel D-15. Acta Ophthalmol 60:907, 1982.

References

Bowman KJ: A method for quantitative scoring of the Farnsworth panel D-15. Acta Ophthalmol 60:907, 1982.

Examples

```
data(BowmanTCDS)
BowmanTCDS
```

calculateCircle	<i>Generate points from a circle</i>
-----------------	--------------------------------------

Description

calculateCircle generates points from a circle with many options, equally spaced, randomly spaced, with noise added to the radius or limited to a segment of angle alpha.

Usage

```
calculateCircle(x, y, r, steps=50, sector=c(0,360), randomDist=FALSE,
randomFun=runif,...)
```

Arguments

x	center point x
y	center point y
r	radius
steps	number of points
sector	limited circular sector
randomDist	logical, TRUE = randomly spaced
randomFun	random function
...	optional parameters to pass to randomFun

Value

points	array n x 2 of point coordinates.
--------	-----------------------------------

Author(s)

Jose Gama

Examples

```
## Not run:
# 100 points from a circle at c(0,0) with radius=200
a<-calculateCircle(0,0,200,100)
plot(a[,1],a[,2],xlim=c(-200,200),ylim=c(-200,200))
par(new=TRUE)
# 12 points from a circle at c(0,0) with radius=190, points between 0 and 90
# degrees
a<-calculateCircle(0,0,190,12,c(0,90))
plot(a[,1],a[,2],xlim=c(-200,200),ylim=c(-200,200),col='red')
par(new=TRUE)
# 12 points from a circle at c(0,0) with radius=180, points between 0 and 180
# degrees, uniform random distribution
a<-calculateCircle(0,0,180,12,c(0,180),TRUE)
plot(a[,1],a[,2],xlim=c(-200,200),ylim=c(-200,200),col='green')
par(new=TRUE)
# 12 points from a circle at c(0,0) with radius=170, points between 0 and 180
# degrees, normal random distribution
a<-calculateCircle(0,0,170,12,c(0,180),TRUE,rnorm)
plot(a[,1],a[,2],xlim=c(-200,200),ylim=c(-200,200),col='blue')

## End(Not run)
```

calculateTES

total error score (TES) using Farnsworth's or Kinnear's method

Description

calculateTES computes the total error score (TES) using Farnsworth's or Kinnear's method for the FM-100, D-15, Roth-28 and so forth. The input is a vector of cap positions.

Usage

```
calculateTES(fmData, Kinnear=FALSE)
```

Arguments

fmData	vector of cap positions
Kinnear	position values chosen by tester

Value

TCDS	Total Color Difference Score (TCDS)
------	-------------------------------------

Author(s)

Jose Gama

References

Farnsworth D. The Farnsworth-Munsell 100-Hue Test. Baltimore: Munsell Color Company, 1957.

Examples

```
# a "perfect" score
## Not run:
calculateTES(userD15values=1:15)
## End(Not run)
```

Color.Vision.c2g *Decolorize an image using the c2g algorithm*

Description

Color.Vision.c2g decolorizes an image using the c2g algorithm from Martin Faust (2008). RGBtoHSL converts from RGB to HSL, used by Color.Vision.c2g

Usage

```
Color.Vision.c2g(fileIN=NULL, fileOUT=NULL, CorrectBrightness=FALSE)
```

Arguments

fileIN	PNG input file
fileOUT	PNG output file
CorrectBrightness	automatic brightness correction

Value

none

Author(s)

Jose Gama

References

Martin Faust 2008 <http://www.e56.de/c2g.php>

Examples

```
## Not run:
fname<-paste(system.file(package='CVD'), '/extdata/fruits.png', sep='')
Color.Vision.c2g(fname, 'fruits.c2g.png')

## End(Not run)
```

`Color.Vision.Daltonize`*Daltonize images*

Description

`Color.Vision.Daltonize` converts images so that the most problematic colors are more visible to people with CVD.

Usage

```
Color.Vision.Daltonize(fileIN=NULL, fileOUT=NULL, myoptions=NULL, amount=1.0)
```

Arguments

<code>fileIN</code>	PNG input file
<code>fileOUT</code>	PNG output file
<code>myoptions</code>	CVD from "Protanope", "Deutanope" or "Tritanope"
<code>amount</code>	UNUSED - level from 0.0 to 1.0 for "Achromat"

Value

none

Author(s)

Jose Gama

References

Michael Deal Daltonize.org <http://mudcu.be/labs/Color/Vision> <http://www.daltonize.org/p/about.html>
"Analysis of Color Blindness" by Onur Fidaner, Poliang Lin and Nevran Ozguven. "Digital Video Colourmaps for Checking the Legibility of Displays by Dichromats" by Francoise Vienot, Hans Brettel and John D. Mollon <http://vision.psychol.cam.ac.uk/jdmollon/papers/colourmaps.pdf>

Examples

```
# a "perfect" score
## Not run:
fname<-paste(system.file(package='CVD'), '/extdata/fruits.png', sep='')
Color.Vision.Daltonize(fname, 'fruits.Daltonize.Protanope.png', 'Protanope')
Color.Vision.Daltonize(fname, 'fruits.Daltonize.Deutanope.png', 'Deutanope')
Color.Vision.Daltonize(fname, 'fruits.Daltonize.Tritanope.png', 'Tritanope')

## End(Not run)
```

Color.Vision.Simulate *Simulate CVDs on images*

Description

Color.Vision.Simulate converts images so that the colors look similar to how they are seen by people with CVD.

Usage

```
Color.Vision.Simulate(fileIN=NULL, fileOUT=NULL, myoptions=NULL, amount=1.0)
```

Arguments

fileIN	PNG input file
fileOUT	PNG output file
myoptions	CVD from "Protanope", "Deuteranope" or "Tritanope"
amount	level from 0.0 to 1.0 for "Achromat"

Value

none

Author(s)

Jose Gama

References

Michael Deal Daltonize.org <http://mudcu.be/labs/Color/Vision> <http://www.daltonize.org/p/about.html>
"Analysis of Color Blindness" by Onur Fidaner, Poliang Lin and Nevran Ozguven. "Digital Video Colourmaps for Checking the Legibility of Displays by Dichromats" by Françoise Vienot, Hans Brettel and John D. Mollon <http://vision.psychol.cam.ac.uk/jdmollon/papers/colourmaps.pdf>

Examples

```
# a "perfect" score
## Not run:
fname<-paste(system.file(package='CVD'), '/extdata/fruits.png', sep='')
Color.Vision.Simulate(fname, 'fruits.Simulate.Protanope.png', 'Protanope')
Color.Vision.Simulate(fname, 'fruits.Simulate.Deuteranope.png', 'Deuteranope')
Color.Vision.Simulate(fname, 'fruits.Simulate.Tritanope.png', 'Tritanope')

## End(Not run)
```

Color.Vision.VingrysAndKingSmith

Scoring the results of the "D-15", "D-15DS" or "FM100-Hue" tests

Description

Color.Vision.VingrysAndKingSmith takes a vector with cap numbers from the "D-15", "D-15DS" or "FM100-Hue" tests and outputs the score by the method from Vingrys and King-Smith.

Usage

```
Color.Vision.VingrysAndKingSmith(capnumbers=NULL, testType='D-15', silent=TRUE)
```

Arguments

capnumbers	vector with cap numbers
testType	test type, one of "D-15", "D-15DS" or "FM100-Hue"
silent	logical, if TRUE then the function will send output to the screen, similarly to the original version

Value

Angle	confusion angle which identifies the type of color defect
MajRad	major moment of inertia
MinRad	minor moment of inertia
TotErr	error score or estimate of the severity of color defect
Sindex	Selectivity-Index which quantifies the amount of polarity or lack of randomness in a cap arrangement
Cindex	Confusion-Index which quantifies the degree of color loss relative to a perfect arrangement of caps

Author(s)

Jose Gama

References

Vingrys, A.J. and King-Smith, P.E. (1988). A quantitative scoring technique for panel tests of color vision. *Investigative Ophthalmology and Visual Science*, 29, 50-63.

Examples

```

Color.Vision.VingrysAndKingSmith(1:15,silent=FALSE)
#result from the original GW Basic version:
#SUMS OF U AND V          41.25999   -4.92
# ANGLE MAJ RAD MIN RAD TOT ERR S-INDEX C-INDEX
#   61.98   9.23   6.71   11.42   1.38   1.00
Color.Vision.VingrysAndKingSmith(1:15,'D-15DS',silent=FALSE)
#result from the original GW Basic version:
#SUMS OF U AND V          26.86001   -38.69
# ANGLE MAJ RAD MIN RAD TOT ERR S-INDEX C-INDEX
#   61.44   5.12   3.60   6.26   1.42   1.00
Color.Vision.VingrysAndKingSmith(1:85, 'FM100-Hue',silent=FALSE)
#result from the original GW Basic version:
#SUMS OF U AND V          423.7896   203.7294
# ANGLE MAJ RAD MIN RAD TOT ERR S-INDEX C-INDEX
#   54.15   2.53   1.97   3.20   1.28   1.00

```

createPNGbuttons *Creates PNG files to be used as colored caps (buttons)*

Description

createPNGbuttons creates PNG files from a data.frame with RGB values.

Usage

```

createPNGbuttons(capsData = get("FarnsworthD15", envir = environment()),
  imgLength = 44, imgWidth = 78)

```

Arguments

capsData	Input file name.
imgLength	Input file name.
imgWidth	Input file name.

Value

png file object.

Author(s)

Jose Gama

Examples

```
## Not run:
createPNGbuttons(data.frame(R=0,G=0,B=0))
data(FarnsworthD15)
createPNGbuttons(FarnsworthD15)

## End(Not run)
```

D15Foutch

*Quantitatively analyzes of D15 color panel tests***Description**

D15Foutch Calculates angle, magnitude and scatter for VK-S 88 and VK-S 93 (Vingrys, A.J. and King-Smith, P.E. (1988, 1993)), LSA 05 (Foutch/Bassi '05), and JMO 11 (Foutch/Stringham/Vengu '11).

Usage

```
D15Foutch(userD15values=NULL, testType = 'D-15', dataVKS = NA)
```

Arguments

userD15values position values chosen by tester
testType the CVD test to be scored: "D-15", "D-15DS", "Roth28-Hue" or "FM100-Hue"
dataVKS by default, the original 1976 CIE Luv data from Vingrys and King-Smith

Value

outmat data.frame with columns "angle", "magnitude" and "scatter" and rows "LSA05", "JMO11", "VKS88", "VKS93"

Author(s)

Brian K. Foutch

References

A new quantitative technique for grading Farnsworth D-15 color panel tests Foutch, Brian K.; Stringham, James M.; Lakshminarayanan, Vasuvedan *Journal of Modern Optics*, vol. 58, issue 19-20, pp. 1755-1763

Evaluation of the new web-based "Colour Assessment and Diagnosis" test J Seshadri, J Christensen, V Lakshminarayanan, *CJ BASSI Optometry & Vision Science* 82 (10), 882-885

Vingrys, A.J. and King-Smith, P.E. (1988). A quantitative scoring technique for panel tests of color vision. *Investigative Ophthalmology and Visual Science*, 29, 50-63.

Examples

```
# 2 examples from VK-S
## Not run:
D15Foutch(userD15values=c(1:7,9,8,10:15))
D15Foutch(userD15values=c(1:7,9,8,10:13,15,14))
## End(Not run)
```

decolorize

Decolorize algorithm from Mark Grundland and Neil A. Dodgson

Description

decolorize converts a color image to contrast enhanced greyscale algorithm from Mark Grundland and Neil A. Dodgson. The input is an array of RGB values and the output is an array with the greyscale values. decolorizeFile sends the output to a file instead of returning an array

Usage

```
decolorize(fileIN=NULL, effect=0.5, scale=NULL, noise=0.001, recolor=FALSE)
```

Arguments

fileIN	PNG file
effect	how much the picture's achromatic content should be altered to accommodate the chromatic contrasts
scale	in pixels is the typical size of relevant color contrast features
noise	noise quantile indicates the amount of noise in the picture enabling the dynamic range of the tones to be appropriately scaled
recolor	return also the chromatic content of the picture

Value

colorArray	array of RGB colors converted to contrast enhanced greyscale.
------------	---

Author(s)

Jose Gama

References

Mark Grundland and Neil A. Dodgson, "Decolorize: Fast, Contrast Enhancing, Color to Grayscale Conversion", Pattern Recognition, vol. 40, no. 11, pp. 2891-2896, (2007). <http://www.Eyemaginary.com/Portfolio/Publication>

Examples

```
## Not run:
samplePics <- c('fruits', 'pastel_color', 'sample1', 'TurnColorsGrayImage1', 'TurnColorsGrayImage2')
for (pics in samplePics)
{
  fname<-paste(system.file(package='CVD'), '/extdata/fruits.png', sep='')
  g1<-decolorize(fname)
  png::writePNG(g1$stones, paste(pics, '.decolorize.png', sep=''))
}

## End(Not run)
```

dichromaticCopunctalPoint

Copunctal points derived by Smith and Pokorny (1975)

Description

dichromaticCopunctalPoint contains the copunctal points derived by Smith and Pokorny (1975)

Usage

```
dichromaticCopunctalPoint
```

Format

This data frame contains the following columns:

- P** copunctal points - protanope
- D** copunctal points - deuteranope
- T** copunctal points - tritanope

Author(s)

Jose Gama

Source

Smith, V. C. & Pokorny, J. Spectral sensitivity of the foveal cone photopigments between 400 and 500 nm. Vision Research, 15, 1975. 161-171.

References

Smith, V. C. & Pokorny, J. Spectral sensitivity of the foveal cone photopigments between 400 and 500 nm. Vision Research, 15, 1975. 161-171.

Examples

```
data(dichromaticCopunctalPoint)
dichromaticCopunctalPoint
```

effectiveCornealFluxDensity
Effective Corneal Flux Density

Description

effectiveCornealFluxDensity computes the effective Corneal Flux Density = product of luminance, area, and the monocular effect, $F = Lae$, from Watson A. B., Yellott J. I. (2012).

Usage

```
effectiveCornealFluxDensity(L=NULL,a=NULL,e=NULL)
```

Arguments

L	luminance in cd m^{-2}
a	field area in deg^2
e	number of eyes (1 or 2)

Value

PupilSize	effective Corneal Flux Density
-----------	--------------------------------

Author(s)

Jose Gama

References

Watson A. B., Yellott J. I. (2012). A unified formula for light-adapted pupil size. *Journal of Vision*, 12(10):12, 1–16.

Examples

```
# effective Corneal Flux Density, luminance in  $\text{cd m}^{-2} = 1$ , field area in  
#  $\text{deg}^2 = 30$ , number of eyes = 2  
## Not run: effectiveCornealFluxDensity(1,30^2,2)
```

effectivePupilArea *Effective area of the illuminated pupil*

Description

effectivePupilArea computes the effective area of the illuminated pupil from its diameter.

Usage

effectivePupilArea(d)

Arguments

d diameter in mm

Value

PupilSize Pupil effective area in mm²

Author(s)

Jose Gama

References

#Smith, VC, Pokorny, J, and Yeh, T: The Farnsworth-Munsell 100-hue test in cone excitation space. Documenta Ophthalmologica Proceedings Series 56:281-291, 1993.

Examples

```
# Pupil area in mm2 for diameter = 2 mm
## Not run: effectivePupilArea(2)
```

example1Lanthony1978 *Example of cap arrangements for the D-15d test, Simple/Extreme Anomalous Trichromacy*

Description

example1Lanthony1978 contains an example of cap arrangements for the D-15d test, Simple/Extreme Anomalous Trichromacy, from Lanthony (1978)

Usage

example1Lanthony1978

Format

This data frame contains the following columns:

SimpleAnomalousTrichromacyD15 example cap arrangements D15 - Simple Anomalous Trichromacy

SimpleAnomalousTrichromacyD15d example cap arrangements D15d - Simple Anomalous Trichromacy

ExtremeAnomalousTrichromacyD15 example cap arrangements D15 - Extreme Anomalous Trichromacy

ExtremeAnomalousTrichromacyD15d example cap arrangements D15d - Extreme Anomalous Trichromacy

Author(s)

Jose Gama

Source

The Desaturated Panel D-15 P. Lanthony Documenta Ophthalmologica 46,1: 185-189, 1978

References

The Desaturated Panel D-15 P. Lanthony Documenta Ophthalmologica 46,1: 185-189, 1978

Examples

```
data(example1Lanthony1978)
example1Lanthony1978
```

example2Lanthony1978 *Example of cap arrangements for the D-15d test, Central Serous Choroidopathy/Optic Neuritis/Autosomal Dominant OpticAtrophy*

Description

example2Lanthony1978 contains an example of cap arrangements for the D-15d test, Central Serous Choroidopathy/Optic Neuritis/Autosomal Dominant OpticAtrophy, from Lanthony (1978)

Usage

```
example2Lanthony1978
```

Format

This data frame contains the following columns:

CentralSerousChoroidopathyD15 example cap arrangements D15 - Central Serous Choroidopathy

CentralSerousChoroidopathyD15d example cap arrangements D15d - Central Serous Choroidopathy

OpticNeuritisD15 example cap arrangements D15 - Optic Neuritis

OpticNeuritisD15d example cap arrangements D15d - Optic Neuritis

AutosomalDominantOpticAtrophyD15 example cap arrangements D15 - Autosomal Dominant Optic Atrophy

AutosomalDominantOpticAtrophyD15d example cap arrangements D15d - Autosomal Dominant Optic Atrophy

Author(s)

Jose Gama

Source

THE DESATURATED PANEL D-15 P. LANTHONY Documenta Ophthalmologica 46,1: 185-189, 1978

References

THE DESATURATED PANEL D-15 P. LANTHONY Documenta Ophthalmologica 46,1: 185-189, 1978

Examples

```
data(example2Lanthony1978)
example2Lanthony1978
```

exampleBowman1982

Example of cap arrangements for the D-15d test

Description

exampleBowman1982 contains an example of cap arrangements for the D-15d test, from Bowman (1982)

Usage

```
exampleBowman1982
```

Format

This data frame contains the following columns:

- A** example cap arrangements A
- B** example cap arrangements B
- C** example cap arrangements C
- D** example cap arrangements D
- E** example cap arrangements E
- F** example cap arrangements F

Author(s)

Jose Gama

Source

A Method For Quantitative Scoring Of The Farnsworth Panel D-15 K.J. Bowman 1982

References

A Method For Quantitative Scoring Of The Farnsworth Panel D-15 K.J. Bowman 1982

Examples

```
data(exampleBowman1982)
exampleBowman1982
```

exampleFarnsworth1974 *Example of cap arrangements for the D-15 test, deuteranope/protanope/tritanope*

Description

exampleFarnsworth1974 contains an example of cap arrangements for the D-15 test, deuteranope/protanope/tritanope, from Farnsworth (1974)

Usage

```
exampleFarnsworth1974
```

Format

This data frame contains the following columns:

- deuteranope** example cap arrangements D15 - deuteranope
- protanope** example cap arrangements D15 - protanope
- tritanope** example cap arrangements D15 - tritanope

Author(s)

Jose Gama

Source

Farnsworth D. The Farnsworth Dichotomous Test for Color Blindness. Panel D-15. New York, Psychological Testing, 1974

References

Farnsworth D. The Farnsworth Dichotomous Test for Color Blindness. Panel D-15. New York, Psychological Testing, 1974

Examples

```
data(exampleFarnsworth1974)
exampleFarnsworth1974
```

exampleFM100

Example of cap arrangements for the FM-100 test

Description

exampleFM100 contains an example of cap arrangements for the FM-100, from Hidayat (2008)

Usage

```
exampleFM100
```

Format

This table contains one example of cap arrangements for the FM-100

Author(s)

Jose Gama

Source

proceedings of the New Zealand Generating fast automated reports for the Farnsworth-Munsell 100-hue colour vision test Ray Hidayat, Computer Science Research Student Conference 2008

References

proceedings of the New Zealand Generating fast automated reports for the Farnsworth-Munsell 100-hue colour vision test Ray Hidayat, Computer Science Research Student Conference 2008

Examples

```
data(exampleFM100)
exampleFM100
```

exampleNRC1981	<i>Example of cap arrangements for the D-15 test, protanope/deutanope/monochromat</i>
----------------	---

Description

exampleNRC1981 contains an example of cap arrangements for the D-15d test, protanope/deutanope/monochromat, from National Research Council (1981)

Usage

```
exampleNRC1981
```

Format

This data frame contains the following columns:

protanope example cap arrangements D15 - protanope

deutanope example cap arrangements D15 - deutanope

monochromat example cap arrangements D15 - monochromat

Author(s)

Jose Gama

Source

Procedures for Testing Color Vision: Report of Working Group 41, 1981, Committee on Vision, National Research Council, pp. 107

References

Procedures for Testing Color Vision: Report of Working Group 41, 1981, Committee on Vision, National Research Council, pp. 107

Examples

```
data(exampleNRC1981)
exampleNRC1981
```

exampleSimunovic2004 *Example of cap arrangements for the D-15 test, rodMonochromat/blueConeMonochromat*

Description

exampleSimunovic2004 contains an example of cap arrangements for the D-15d test, rodMonochromat/blueConeMonochromat, from Lanthony (1978)

Usage

```
exampleSimunovic2004
```

Format

This data frame contains the following columns:

rodMonochromat example cap arrangements D15 - rodMonochromat

blueConeMonochromat example cap arrangements D15 - blueConeMonochromat

Author(s)

Jose Gama

Source

Cone dystrophies Part 2 Cone dysfunction syndromes, Matthew P Simunovic

References

Cone dystrophies Part 2 Cone dysfunction syndromes, Matthew P Simunovic

Examples

```
data(exampleSimunovic2004)  
exampleSimunovic2004
```

FarnsworthD15

Farnsworth D-15 cap colors

Description

FarnsworthD15 contains the cap colors for the D-15 tests, in CIELab and RGB from Farnsworth D (1947) The Farnsworth Dichotomous test (D-15) is a short test for detecting congenital color vision deficiencies.

Usage

FarnsworthD15

Format

This data frame contains the following columns:

CapNo Cap Number

Munsell Munsell color

x.C CIE x cap color

y.C CIE y cap color

R R channel cap color

G G channel cap color

B B channel cap color

Author(s)

Jose Gama

Source

Farnsworth D. The Farnsworth Dichotomous Test for Color Blindness Panel D-15 Manual. New York, The Psychological Corp., 1947, pp. 1-8.

References

Farnsworth D. The Farnsworth Dichotomous Test for Color Blindness Panel D-15 Manual. New York, The Psychological Corp., 1947, pp. 1-8.

Examples

```
data(FarnsworthD15)
FarnsworthD15
```

FarnsworthMunsell100Hue

Farnsworth D-15 cap colors

Description

FarnsworthMunsell100Hue contains the cap colors for the Farnsworth Munsell 100-Hue tests, in CIE Lab and RGB from Farnsworth D (1957) The Farnsworth Munsell 100-Hue is a test for detecting congenital and acquired color vision deficiencies.

Usage

```
FarnsworthMunsell100Hue
```

Format

This data frame contains the following columns:

CapNo Cap Number

Munsell Munsell color

x.C CIE x cap color

y.C CIE y cap color

R R channel cap color

G G channel cap color

B B channel cap color

Author(s)

Jose Gama

Source

Farnsworth D: The Farnsworth-Munsell 100-Hue Test for the Examination of Color Discrimination Manual. Baltimore, Munsell Color Co., 1957, pp. 1-7.

References

Farnsworth D: The Farnsworth-Munsell 100-Hue Test for the Examination of Color Discrimination Manual. Baltimore, Munsell Color Co., 1957, pp. 1-7.

Examples

```
data(FarnsworthMunsell100Hue)
FarnsworthMunsell100Hue
```

GellerTCDS

Table of color distance scores for quantitative scoring of the Lanthony desaturate D-15s test

Description

GellerTCDS contains the color distance scores for quantitative scoring of the Lanthony desaturate D-15s test, from Geller AM. (2001). The Lanthony desaturate test (D-15s) is a short test for detecting acquired color vision deficiencies. Geller AM (2001) created a table based on the Commission Internationale de l'Eclairage (International Commission on Illumination, CIE) Space and Color Difference formula, CIE 1976 (L*a*b*) with perceptual distances between pairs of caps. The table is used for the calculation of the Total Color Distance Score (TCDS) which is the sum of the CIELAB space distances between colored caps.

Usage

GellerTCDS

Format

This data frame contains the following columns:

Pilot Distances between colored caps for the pilot cap
Cap1 Distances between colored caps for the 1st cap
Cap2 Distances between colored caps for the 2nd cap
Cap3 Distances between colored caps for the 3rd cap
Cap4 Distances between colored caps for the 4th cap
Cap5 Distances between colored caps for the 5th cap
Cap6 Distances between colored caps for the 6th cap
Cap7 Distances between colored caps for the 7th cap
Cap8 Distances between colored caps for the 8th cap
Cap9 Distances between colored caps for the 9th cap
Cap10 Distances between colored caps for the 10th cap
Cap11 Distances between colored caps for the 11th cap
Cap12 Distances between colored caps for the 12th cap
Cap13 Distances between colored caps for the 13th cap
Cap14 Distances between colored caps for the 14th cap
Cap15 Distances between colored caps for the 15th cap

Author(s)

Jose Gama

Source

Geller AM. A table of color distance scores for quantitative scoring of the Lanthony desaturate color vision test. *Neurotoxicol Teratol* 2001; 23: 265-267.

References

Geller AM. A table of color distance scores for quantitative scoring of the Lanthony desaturate color vision test. *Neurotoxicol Teratol* 2001; 23: 265-267.

Examples

```
data(GellerTCDS)
GellerTCDS
```

greyscale.avg

Greyscale algorithms

Description

Common algorithms to convert color images to greyscale. The input is an array of RGB values and the output is an array with the greyscale values. `greyscale.avg` Greyscale algorithm, convert to average RGB values. `greyscale.Y` Greyscale algorithm YIQ/NTSC - RGB colors in a gamma 2.2 color space. `greyscale.linear` Greyscale algorithm linear RGB colors `greyscale.RMY` Greyscale algorithm RMY `greyscale.BT709` Greyscale algorithm BT709 `greyscale.luminosity` Greyscale algorithm using luminosity

Usage

```
greyscale.avg(colorArray)
```

Arguments

`colorArray` array of RGB colors.

Value

`colorArray` array of RGB colors converted to greyscale.

Author(s)

Jose Gama

Examples

```
## Not run:
samplePics <- c('fruits', 'pastel_color', 'sample1', 'TurnColorsGrayImage1', 'TurnColorsGrayImage2')
for (pics in samplePics)
{
fname<-paste(system.file(package='CVD'), '/extdata/', pics, '.png', sep='')
imgTest<-loadPNG(fname)
g1<-greyscale.avg(imgTest)
png::writePNG(g1, paste(pics, '.greyscale.avg.png', sep=''))
}

imgTest<-loadPNG(fname)
g1<-greyscale.avg(imgTest)
png::writePNG(g1, paste(pics, '.greyscale.avg.png', sep=''))
g1<-greyscale.BT709(imgTest)
png::writePNG(g1, paste(pics, '.BT709.png', sep=''))
g1<-greyscale.Linear(imgTest)
png::writePNG(g1, paste(pics, '.Linear.png', sep=''))
g1<-greyscale.Luminosity(imgTest)
png::writePNG(g1, paste(pics, '.Luminosity.png', sep=''))
g1<-greyscale.RMY(imgTest)
png::writePNG(g1, paste(pics, '.RMY.png', sep=''))
g1<-greyscale.Y(imgTest)
png::writePNG(g1, paste(pics, '.Y.png', sep=''))

## End(Not run)
```

H16

Farnsworth H-16 cap colors

Description

H16 contains the cap colors for the Farnsworth H-16 test, in Yxy coordinates. The Farnsworth H-16 is a short test for detecting congenital color vision deficiencies.

Usage

H16

Format

This data frame contains the following columns:

CapNo Cap Number

x.C CIE x cap color

y.C CIE y cap color

Munsell Munsell color

ProductionNo Munsell Production Number

Author(s)

Jose Gama

Source

Judd, D.B. and MacAdam, D.L., 1979 Contributions to Color Science University of Rochester. Institute of Optics and Center for Building Technology Department of Commerce, National Bureau of Standards

References

Judd, D.B. and MacAdam, D.L., 1979 Contributions to Color Science University of Rochester. Institute of Optics and Center for Building Technology Department of Commerce, National Bureau of Standards

Examples

```
data(H16)
H16
```

`illuminance2troland` *Convert from luminance to troland and effective troland*

Description

`illuminance2troland` convert from illuminance (lux) to conventional retinal illuminance (troland) and effective troland (trolands per effective area). `luminance2troland` convert from luminance (cd/m^2) to troland and effective troland.

Usage

```
luminance2troland(Lv, d=NA)
illuminance2troland(Ev, lumFactor, d=NA)
```

Arguments

<code>d</code>	diameter in mm
<code>Lv</code>	luminance (cd/m^2)
<code>Ev</code>	illuminance (lux)
<code>lumFactor</code>	luminance factor

Value

<code>troland</code>	conventional retinal illuminance (troland)
<code>effectivetroland</code>	effective troland (trolands per effective area)

Author(s)

Jose Gama

References

#Smith, VC, Pokorny, J, and Yeh, T: The Farnsworth-Munsell 100-hue test in cone excitation space. Documenta Ophthalmologica Proceedings Series 56:281-291, 1993.

Examples

```
# Pupil area in mm^2 for diameter = 2 mm
## Not run: illuminance2troland(2)
```

```
interpretation.VingrysAndKingSmith
      Automatic interpretation of test scores
```

Description

interpretation.VingrysAndKingSmith and interpretation.Foutch perform an interpretation of the test results based on the classification ranges from the authors of the tests.

Usage

```
interpretation.VingrysAndKingSmith(VKS,optMethod=88)
```

Arguments

VKS	data to be interpreted
optMethod	CVD test method

Value

TCDS	Total Color Difference Score (TCDS)
------	-------------------------------------

Author(s)

Jose Gama

References

Vingrys, A.J. and King-Smith, P.E. (1988). A quantitative scoring technique for panel tests of color vision. Investigative Ophthalmology and Visual Science, 29, 50-63.

A new quantitative technique for grading Farnsworth D-15 color panel tests Foutch, Brian K.; Stringham, James M.; Lakshminarayanan, Vasuvedan Journal of Modern Optics, vol. 58, issue 19-20, pp. 1755-1763

Evaluation of the new web-based "Colour Assessment and Diagnosis" test J Seshadri, J Christensen, V Lakshminarayanan, CJ BASSI Optometry & Vision Science 82 (10), 882-885

Examples

```
# a "perfect" score
## Not run:
interpretation.VingrystAndKingSmith(D15Foutch(1:15))
## End(Not run)
```

LanthonyD15

Farnsworth H-16 cap colors

Description

LanthonyD15 contains the cap colors for Lanthony D-15 test, in Yxy coordinates. The Lanthony D-15 (desaturated D-15) is a short test for detecting congenital color vision deficiencies.

Usage

```
LanthonyD15
```

Format

This data frame contains the following columns:

CapNo Cap Number

Munsell Munsell color

x.C CIE x cap color

y.C CIE y cap color

R R channel cap color

G G channel cap color

B B channel cap color

Author(s)

Jose Gama

Source

Judd, D.B. and MacAdam, D.L., 1979 Contributions to Color Science University of Rochester. Institute of Optics and Center for Building Technology Department of Commerce, National Bureau of Standards

References

Judd, D.B. and MacAdam, D.L., 1979 Contributions to Color Science University of Rochester. Institute of Optics and Center for Building Technology Department of Commerce, National Bureau of Standards

Examples

```
data(LanthonyD15)
LanthonyD15
```

```
lightAdaptedPupilSize.Barten
pupil diameter ranges from Barten, L. (1999)
```

Description

lightAdaptedPupilSize.Barten computes the pupil diameter ranges from Barten, L. (1999).

Usage

```
lightAdaptedPupilSize.Barten(L=NULL, a=NULL)
```

Arguments

L	luminance in cd m^{-2}
a	area in deg^2

Value

PupilSize	Pupil size in mm
-----------	------------------

Author(s)

Jose Gama

References

Watson A. B., Yellott J. I. (2012). A unified formula for light-adapted pupil size. *Journal of Vision*, 12(10):12, 1–16. <http://journalofvision.org/12/10/12/>, doi:10.1167/5.9.6. Barten, P. G. J. (1999). *Contrast sensitivity of the human eye and its effects on image quality*. Bellingham, WA: SPIE Optical Engineering Press.

Examples

```
# Pupil diameter in mm for luminance = 1  $\text{cd m}^{-2}$ , field diameter = 30 degrees
## Not run: lightAdaptedPupilSize.Barten(1,30^2)
```

`lightAdaptedPupilSize.BlackieAndHowland`

pupil diameter ranges from Blackie, C. A., & Howland, H. C. (1999)

Description

`lightAdaptedPupilSize.BlackieAndHowland` computes the pupil diameter ranges from Blackie, C. A., & Howland, H. C., (1999).

Usage

```
lightAdaptedPupilSize.BlackieAndHowland(L=NULL)
```

Arguments

L	luminance in cd m^{-2}
---	---------------------------------

Value

PupilSize	Pupil size in mm
-----------	------------------

Author(s)

Jose Gama

References

Watson A. B., Yellott J. I. (2012). A unified formula for light-adapted pupil size. *Journal of Vision*, 12(10):12, 1–16. <http://journalofvision.org/12/10/12/>, doi:10.1167/5.9.6. Blackie, C. A., & Howland, H. C. (1999). An extension of an accommodation and convergence model of emmetropization to include the effects of illumination intensity. *Ophthalmic and Physiological Optics*, 19(2), 112–125.

Examples

```
# Pupil diameter in mm for luminance = 1  $\text{cd m}^{-2}$   
## Not run: lightAdaptedPupilSize.BlackieAndHowland(1)
```

lightAdaptedPupilSize.Crawford
pupil diameter ranges from Crawford, L. (1936)

Description

lightAdaptedPupilSize.Crawford computes the pupil diameter ranges from Crawford, L. (1936).

Usage

```
lightAdaptedPupilSize.Crawford(L=NULL)
```

Arguments

L	luminance in cd m^{-2}
---	---------------------------------

Value

PupilSize	Pupil size in mm
-----------	------------------

Author(s)

Jose Gama

References

Watson A. B., Yellott J. I. (2012). A unified formula for light-adapted pupil size. *Journal of Vision*, 12(10):12, 1–16. <http://journalofvision.org/12/10/12/>, doi:10.1167/5.9.6. Crawford, B. H. (1936). The dependence of pupil size upon external light stimulus under static and variable conditions. *Proceedings of the Royal Society of London, Series B, Biological Sciences*, 121(823), 376–395.

Examples

```
# Pupil diameter in mm for luminance = 1  $\text{cd m}^{-2}$   
## Not run: lightAdaptedPupilSize.Crawford(1)
```

lightAdaptedPupilSize.DeGrootAndGebhard
pupil diameter ranges from DeGrootAndGebhard, L. (1952)

Description

lightAdaptedPupilSize.DeGrootAndGebhard computes the pupil diameter ranges from DeGrootAndGebhard, L. (1952).

Usage

```
lightAdaptedPupilSize.DeGrootAndGebhard(L=NULL)
```

Arguments

L luminance in cd m^{-2}

Value

PupilSize Pupil size in mm

Author(s)

Jose Gama

References

Watson A. B., Yellott J. I. (2012). A unified formula for light-adapted pupil size. *Journal of Vision*, 12(10):12, 1–16. <http://journalofvision.org/12/10/12/>, doi:10.1167/5.9.6. De Groot, S. G., & Gebhard, J. W. (1952). Pupil size as determined by adapting luminance. *Journal of the Optical Society of America A*, 42(7), 492–495.

Examples

```
# Pupil diameter in mm for luminance = 1  $\text{cd m}^{-2}$   
## Not run: lightAdaptedPupilSize.DeGrootAndGebhard(1)
```

```
lightAdaptedPupilSize.Holladay
```

pupil diameter ranges from Holladay, L. (1926)

Description

`lightAdaptedPupilSize.Holladay` computes the pupil diameter ranges from Holladay, L. (1926).

Usage

```
lightAdaptedPupilSize.Holladay(L=NULL)
```

Arguments

L luminance in cd m^{-2}

Value

PupilSize Pupil size in mm

Author(s)

Jose Gama

References

Watson A. B., Yellott J. I. (2012). A unified formula for light-adapted pupil size. *Journal of Vision*, 12(10):12, 1–16. <http://journalofvision.org/12/10/12/>, doi:10.1167/5.9.6. Holladay, L. (1926). The fundamentals of glare and visibility. *Journal of the Optical Society of America*, 12(4), 271–319.

Examples

```
# Pupil diameter in mm for luminance = 1 cd m^-2
## Not run: lightAdaptedPupilSize.Holladay(1)
```

```
lightAdaptedPupilSize.LeGrand
      pupil diameter ranges from Le Grand (1992)
```

Description

lightAdaptedPupilSize.LeGrand computes the pupil diameter ranges from Le Grand (1992).

Usage

```
lightAdaptedPupilSize.LeGrand(L=NULL)
```

Arguments

L	luminance in cd m ⁻²
---	---------------------------------

Value

PupilSize	Pupil size in mm
-----------	------------------

Author(s)

Jose Gama

References

Vision, Pierre A. Buser, Michel Imbert, MIT Press, 1992

Examples

```
# Pupil diameter in mm for luminance = 1 cd m^-2
## Not run: lightAdaptedPupilSize.LeGrand(1)
```

`lightAdaptedPupilSize.MoonAndSpencer`*pupil diameter ranges from MoonAndSpencer, L. (1944)*

Description

`lightAdaptedPupilSize.MoonAndSpencer` computes the pupil diameter ranges from MoonAndSpencer, L. (1944).

Usage

```
lightAdaptedPupilSize.MoonAndSpencer(L=NULL)
```

Arguments

L	luminance in cd m^{-2}
---	---------------------------------

Value

PupilSize	Pupil size in mm
-----------	------------------

Author(s)

Jose Gama

References

Watson A. B., Yellott J. I. (2012). A unified formula for light-adapted pupil size. *Journal of Vision*, 12(10):12, 1–16. <http://journalofvision.org/12/10/12/>, doi:10.1167/5.9.6. Moon, P., & Spencer, D. E. (1944). On the Stiles-Crawford effect. *Journal of the Optical Society of America*, 34(6), 319–329, <http://www.opticsinfobase.org/abstract.cfm?URI14josa-34-6-319>.

Examples

```
# Pupil diameter in mm for luminance = 1 cd m-2  
## Not run: lightAdaptedPupilSize.MoonAndSpencer(1)
```

`lightAdaptedPupilSize.StanleyAndDavies`*pupil diameter ranges from StanleyAndDavies, L. (1995)*

Description

`lightAdaptedPupilSize.StanleyAndDavies` computes the pupil diameter ranges from StanleyAndDavies, L. (1995).

Usage

```
lightAdaptedPupilSize.StanleyAndDavies(L=NULL, a=NULL)
```

Arguments

<code>L</code>	luminance in cd m^{-2}
<code>a</code>	area in deg^2

Value

<code>PupilSize</code>	Pupil size in mm
------------------------	------------------

Author(s)

Jose Gama

References

Watson A. B., Yellott J. I. (2012). A unified formula for light-adapted pupil size. *Journal of Vision*, 12(10):12, 1–16. <http://journalofvision.org/12/10/12/>, doi:10.1167/5.9.6. Stanley, P. A., & Davies, A. K. (1995). The effect of field of view size on steady-state pupil diameter. *Ophthalmic & Physiological Optics*, 15(6), 601–603.

Examples

```
# Pupil diameter in mm for luminance = 1 cd m-2, field diameter = 30 degrees  
## Not run: lightAdaptedPupilSize.StanleyAndDavies(1,302)
```

lightAdaptedPupilSize.WatsonAndYellott

pupil diameter ranges from Watson A. B., Yellott J. I. (2012)

Description

lightAdaptedPupilSize.WatsonAndYellott computes the pupil diameter ranges from Watson A. B., Yellott J. I. (2012).

Usage

```
lightAdaptedPupilSize.WatsonAndYellott(L=NULL, a=NULL, y=NULL, y0=NULL, e=NULL)
```

Arguments

L	luminance in cd m^{-2}
a	area in deg^2
y	age in years
y0	reference age
e	number of eyes (1 or 2)

Value

PupilSize	Pupil size in mm
-----------	------------------

Author(s)

Jose Gama

References

Watson A. B., Yellott J. I. (2012). A unified formula for light-adapted pupil size. *Journal of Vision*, 12(10):12, 1–16. <http://www.ncbi.nlm.nih.gov/pubmed/23012448>

Examples

```
# Pupil diameter in mm for luminance = 1 cd m-2, field diameter = 30 degrees,  
# age=45, estimated reference age = 28.58, eyes = 2  
## Not run: lightAdaptedPupilSize.WatsonAndYellott(1,302,45,28.58,2)
```

lightAdaptedPupilSize.WinnEtAl
pupil diameter ranges from Winn et al (1995)

Description

lightAdaptedPupilSize.WinnEtAl computes the pupil diameter ranges from Winn et al (1995).

Usage

```
lightAdaptedPupilSize.WinnEtAl(L=NULL, y=NULL)
```

Arguments

L	luminance in cd m^{-2}
y	age in years

Value

PupilSize	Pupil size in mm
-----------	------------------

Author(s)

Jose Gama

References

Watson A. B., Yellott J. I. (2012). A unified formula for light-adapted pupil size. *Journal of Vision*, 12(10):12, 1–16. <http://journalofvision.org/12/10/12/>, doi:10.1167/5.9.6. Winn, B., Whitaker, D., Elliott, D. B., & Phillips, N. J. (1994). Factors affecting light-adapted pupil size in normal human subjects. *Investigative Ophthalmology & Visual Science*, 35(3):1132–1137, <http://www.iovs.org/content/35/3/1132>.

Examples

```
# Pupil diameter in mm for luminance = 1  $\text{cd m}^{-2}$ , age = 45 years  
## Not run: lightAdaptedPupilSize.WinnEtAl(1,45)
```

loadPNG *Load a PNG file*

Description

loadPNG loads a PNG file and displays the image dimensions.

Usage

```
loadPNG(fileIN=NULL, silent=FALSE)
```

Arguments

fileIN	Input file name.
silent	Logic, TRUE=do not display image dimensions.

Value

png file object.

Author(s)

Jose Gama

Examples

```
## Not run:  
loadPNG(paste(system.file(package='CVD'), '/inst/extdata/fruits.png', sep=''))  
  
## End(Not run)
```

neutralPoint *Neutral points for CIE 1976 uv, CIE 1931 xy and CIE 1960 uv*

Description

neutralPoint contains the neutral points for CIE 1976 uv, CIE 1931 xy and CIE 1960 uv

Usage

```
neutralPoint
```

Format

This data frame contains the following columns:

CIE1931xy neutral point CIE 1931 xy

CIE1960uv neutral point CIE 1976 uv

CIE1960uv neutral point CIE 1960 uv

Author(s)

Jose Gama

Examples

```
data(neutralPoint)
neutralPoint
```

plotConfusionVectors *Plot confusion vectors for CIE 1976 uv, CIE 1931 xy and CIE 1960 uv*

Description

plotConfusionVectors Plots the confusion vectors for CIE 1976 uv, CIE 1931 xy and CIE 1960 uv.

Usage

```
plotConfusionVectors(colorSpace='CIE1931xy')
```

Arguments

colorSpace chosen colorSpace, default='CIE1931xy'

Value

none

Author(s)

Jose Gama

Examples

```
# find duplicate values
## Not run: plotConfusionVectors()
```

Roth28

Roth-28 cap colors

Description

Roth28 contains the cap colors for the Roth-28 tests, in CIELab and RGB from Roth A (1966) The Roth-28 is a short test for detecting congenital color vision deficiencies.

Usage

Roth28

Format

This data frame contains the following columns:

CIEL CIELab L channel cap color

CIEa CIELab a channel cap color

CIEb CIELab b channel cap color

R R channel cap color

G G channel cap color

B B channel cap color

Author(s)

Jose Gama

Source

Roth A. Test-28 hue de Roth selon Farnsworth–Munsell (Manual). Paris: Luneau, 1966.

References

Roth A. Test-28 hue de Roth selon Farnsworth–Munsell (Manual). Paris: Luneau, 1966.

Examples

```
data(Roth28)
Roth28
```

scoreD15Graphic	<i>Graphical score for the D-15 tests</i>
-----------------	---

Description

scoreD15Graphic computes the graphical score for the D-15 test or similar. The input is either a vector of RGB colors or cap positions.

Usage

```
scoreD15Graphic(userD15colors=NULL,userD15values=NULL, titleGraphic=
"Farnsworth dichotomous test (D-15) results", okD15colors=NULL)
```

Arguments

userD15colors	RGB colors chosen by tester
userD15values	position values chosen by tester
titleGraphic	title for the graphic
okD15colors	vector with RGB colors in the correct sequence

Value

none

Author(s)

Jose Gama

References

Farnsworth D. The Farnsworth Dichotomous Test for Color Blindness Panel D-15 Manual. New York, The Psychological Corp., 1947, pp. 1-8.

Examples

```
# a "perfect" score
## Not run: scoreD15Graphic(userD15values=1:15)
```

`scoreD15TCDS`*Total Color Difference Score (TCDS) for the D-15 tests*

Description

`scoreD15TCDS` computes the Total Color Difference Score (TCDS) for the D-15 test, from Bowman's (1982). The input is either a vector of RGB colors or cap positions.

Usage

```
scoreD15TCDS(userD15colors=NULL,userD15values=NULL,  
  distTable = get("BowmanTCDS", envir = environment()),  
  D15colors = get("FarnsworthD15", envir = environment()))
```

Arguments

<code>userD15colors</code>	RGB colors chosen by tester
<code>userD15values</code>	position values chosen by tester
<code>distTable</code>	distance table - matrix with the color distances
<code>D15colors</code>	RGB colors for the CVD test

Value

TCDS	Total Color Difference Score (TCDS)
------	-------------------------------------

Author(s)

Jose Gama

References

Bowman's (1982) Total Color Difference Score (TCDS) for congenitally defective observers on the D-15 with enlarged tests. K.J. Bowman, A method for quantitative scoring of the Farnsworth Panel D-15, *Acta Ophthalmologica*, 60 (1982), pp. 907–916

Examples

```
# a "perfect" score  
## Not run:  
scoreD15TCDS(userD15values=1:15)  
## End(Not run)
```

scoreFM100Graphic *Graphical score for the D-15 tests*

Description

scoreFM100Graphic computes the graphical score for the FM-100 test or similar. The input is either a vector of RGB colors or cap positions.

Usage

```
scoreFM100Graphic(userFM100colors=NULL,userFM100values=NULL, titleGraphic=
"Farnsworth Munsell 100-Hue test results", okFM100colors=NULL, Kinnear=FALSE)
```

Arguments

userFM100colors	RGB colors chosen by tester
userFM100values	position values chosen by tester
titleGraphic	title for the graphic
okFM100colors	vector with RGB colors in the correct sequence
Kinnear	logical, scoring method TRUE = Farnsworth, FALSE = Kinnear

Value

none

Author(s)

Jose Gama

References

Dean Farnsworth, 1943 The Farnsworth Munsell 100-hue dichotomous tests for colour vision Journal of the Optical Society of America, 33 (1943), pp. 568–576

Examples

```
# an example score
## Not run:
FM100example<-exampleFM100
userFM100values=cbind(FM100example[1,], FM100example[4,-22],
  FM100example[7,-22], FM100example[10,-22])
userFM100values=as.vector(unlist(userFM100values))
scoreFM100Graphic(userFM100values)

## End(Not run)
```

scoreRoth28Graphic *Graphical score for the D-15 tests*

Description

scoreRoth28Graphic computes the graphical score for the Roth-28 test or similar. The input is either a vector of RGB colors or cap positions.

Usage

```
scoreRoth28Graphic(userR28colors=NULL,userR28values=NULL, titleGraphic="Roth-28 test results", okR28colors=NULL)
```

Arguments

userR28colors	RGB colors chosen by tester
userR28values	position values chosen by tester
titleGraphic	title for the graphic
okR28colors	vector with RGB colors in the correct sequence

Value

none

Author(s)

Jose Gama

References

Carl Erb, Martin Adler, Nicole Stübiger, Michael Wohlrab, Eberhart Zrenner, Hans-Jürgen Thiel, Colour vision in normal subjects tested by the colour arrangement test ‘Roth 28-hue desaturated’, Vision Research, Volume 38, Issue 21, November 1998, Pages 3467-3471, ISSN 0042-6989, [http://dx.doi.org/10.1016/S0042-6989\(97\)00433-1](http://dx.doi.org/10.1016/S0042-6989(97)00433-1).

Examples

```
# a "perfect" score
## Not run: scoreRoth28Graphic(userD15values=1:28)
```

showDuplicated	<i>Show missing and duplicated cap numbers</i>
----------------	--

Description

showDuplicated shows missing and duplicated cap numbers from D-15, D15d, FM-100 and similar tests.

Usage

```
showDuplicated(cnum)
```

Arguments

cnum	cap numbers
------	-------------

Value

none

Author(s)

Jose Gama

Examples

```
# find duplicate values
## Not run: showDuplicated(1:15)
showDuplicated(c(1:4,8,5:14))
# this is an example of a typo in data from a publication
#Procedures for Testing Color Vision: Report of Working Group 41, 1981,
#Committee on Vision, National Research Council, pp. 107
#the "monochromat" data has "16" instead of "6"
data(exampleNRC1981)
showDuplicated(exampleNRC1981[,3])

## End(Not run)
```

typicalD15	<i>Typical cap arrangements for the D-15 tests</i>
------------	--

Description

typicalD15 contains typical cap arrangements for the D-15 tests, from Farnsworth D (1947), Simunovic (1998) and NRC (1981)

Usage

```
typicalD15
```

Format

This data frame contains the following columns:

protanope typical cap arrangements - protanope

deuteranope typical cap arrangements - deuteranope

tritanope typical cap arrangements - tritanope

monochromat typical cap arrangements - monochromat

rodMonochromat typical cap arrangements - rodMonochromat

blueConeMonochromat typical cap arrangements - blueConeMonochromat

Author(s)

Jose Gama

Source

Farnsworth D. The Farnsworth Dichotomous Test for Color Blindness Panel D-15 Manual. New York, The Psychological Corp., 1947, pp. 1-8. Simunovic MP, Moore AT. The cone dystrophies. Eye 1998;12:553–65. National Research Council (US). Committee on Vision. Procedures for testing color vision: report of Working Group 41. National Academies Press, 1981.

References

Farnsworth D. The Farnsworth Dichotomous Test for Color Blindness Panel D-15 Manual. New York, The Psychological Corp., 1947, pp. 1-8. Simunovic MP, Moore AT. The cone dystrophies. Eye 1998;12:553–65. National Research Council (US). Committee on Vision. Procedures for testing color vision: report of Working Group 41. National Academies Press, 1981.

Examples

```
data(typicalD15)
typicalD15
```

vectorPNGbuttons

Vector of PNG files representing colored caps (buttons)

Description

vectorPNGbuttons returns a vector with the filenames of the PNG files representing colored caps (buttons) from a data.frame.

Usage

```
vectorPNGbuttons(capsData=get("FarnsworthD15", envir = environment()))
```

Arguments

capsData data.frame with RGB values of colored caps (buttons).

Value

vector with path+filenames of PNG files.

Author(s)

Jose Gama

Examples

```
## Not run:
vectorPNGbuttons(FarnsworthD15)

## End(Not run)
```

VKSgraphic

Graphical score for the D-15 tests

Description

VKSgraphic computes a graphical score based on the Vingrys and King-Smith method (VKS) for the D-15 test or similar tests. VKSvariantGraphic shows the angles with double their value, for a continuous display of the confusion axis.

Usage

```
VKSgraphic(VKSdata, xLimit=5, yLimit=4, VKStitle='', VKSxlabel='',
VKSylabel='')
```

Arguments

VKSdata data.frame with color vision deficiency name, VKS angle and VKS index
xLimit X-axis boundaries
yLimit Y-axis boundaries
VKStitle title for the plot
VKSxlabel text for the x label
VKSylabel text for the y label

Value

none

Author(s)

Jose Gama

Source

VKSvariantGraphic - original idea by David Bimler Atchison DA, Bowman KJ, Vingrys AJ Quantitative scoring methods for D15 panel tests in the diagnosis of congenital colour-vision deficiencies. Optometry and Vision Science 1991, 68:41-48.

References

Atchison DA, Bowman KJ, Vingrys AJ Quantitative scoring methods for D15 panel tests in the diagnosis of congenital colour-vision deficiencies. Optometry and Vision Science 1991, 68:41-48.

Examples

```
# Creating similar graphics to "A Quantitative Scoring Technique For Panel
#Tests of Color Vision" Algis J. Vingrys and P. Ewen King-Smith
## Not run:
VKSdata<-VKStable2[,c(1,3:5)]
VKSdata[1,1]<-'Normal no error'
VKSdata[2:9,1]<-'Normal'
VKSdata[10:13,1]<-'Acquired CVD'
# the graphics are similar but not identical because the data used in the
#plots is the average of the values instead of all the values
VKSgraphic(VKSdata[,1:3],5,4,'D-15 angle vs C-index (Average)','Angle',
'C-index') # Fig. 6
VKSgraphic(VKSdata[,c(1,2,4)],5,4,'D-15 angle vs S-index (Average)','Angle',
'S-index') # Fig. 7

## End(Not run)
```

VKStable2

Table with results of D-15 tests scored with the Vingrys and King-Smith method

Description

VKStable2 contains the results of D-15 tests scored with the Vingrys and King-Smith method, from Vingrys and King-Smith (1988), table 2

Usage

VKStable2

Format

This data frame contains the following columns:

typeCVD Type of color vision

sample Number in sample

Angle Angle

S.index S-index

C.index C-index

Major Major radius

Minor Minor radius

TES TES

TCDS TCDS

Author(s)

Jose Gama

Source

Atchison DA, Bowman KJ, Vingrys AJ Quantitative scoring methods for D15 panel tests in the diagnosis of congenital colour-vision deficiencies. *Optometry and Vision Science* 1991, 68:41-48.

References

Atchison DA, Bowman KJ, Vingrys AJ Quantitative scoring methods for D15 panel tests in the diagnosis of congenital colour-vision deficiencies. *Optometry and Vision Science* 1991, 68:41-48.

Examples

```
data(VKStable2)
VKStable2
```

XYZ2scotopic.Rawtran *Approximation of the scotopic luminance*

Description

XYZ2scotopic.Rawtran approximates the scotopic luminance from XYZ values, illuminant D65, from Filip Hroch (1998). Used in the astronomy software Rawtran.

XYZ2scotopic.Rawtran.array idem, however the data type used is array.

Usage

```
XYZ2scotopic.Rawtran(XYZmatrix)
```

Arguments

XYZmatrix matrix (or array) with XYZ values

Value

Matrix (or array) with approximated scotopic luminance.

Author(s)

Jose Gama

Source

Filip Hroch, 1998, Computer Programs for CCD Photometry, 20th Stellar Conference of the Czech and Slovak Astronomical Institutes, Dusek J., <http://adsabs.harvard.edu/abs/1998stel.conf...30H Rawtran-integral.physics.muni.cz> Masaryk University <http://integral.physics.muni.cz/rawtran/>

References

Filip Hroch, 1998, Computer Programs for CCD Photometry, 20th Stellar Conference of the Czech and Slovak Astronomical Institutes, Dusek J., <http://adsabs.harvard.edu/abs/1998stel.conf...30H Rawtran-integral.physics.muni.cz> Masaryk University <http://integral.physics.muni.cz/rawtran/>

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