

Chapter **17**

Graphical Concepts

practical
computing
for
biologists

HADDOCK • DUNN

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13th of april



Practical computing for **biologists**

Chapter **17**



Graphical concepts

General image types

- *Vector vs pixel*
- *Deciding when to use vector art, pixel art or both*

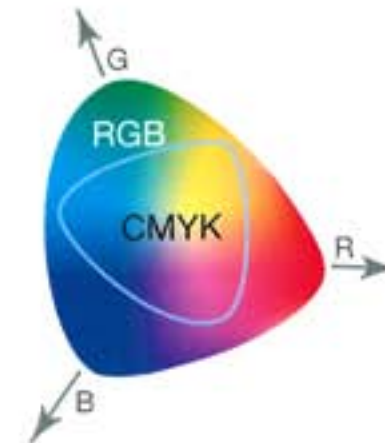
Image resolution and dimensions

Image colors

- *Color models and space*
- *Converting between color models*
- *Color profiles*
- *Color choices*

Layers

Why you should avoid powerpoint ?





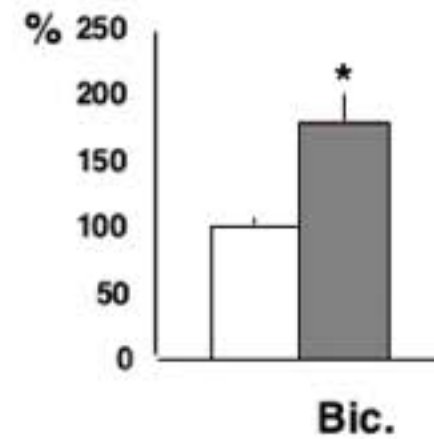
General Image Types



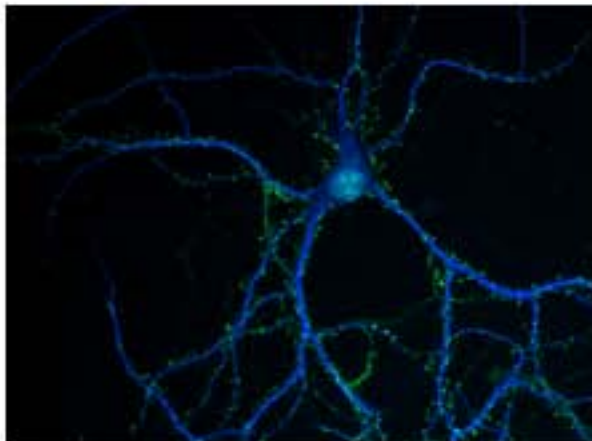
• Vector-based image :



Made of **editable lines, curves, and shape** which are defined by a few key properties.



• Pixel-based image = bitmap = raster art :



Made of uniform grid or colored dots, named **the pixels**.

Photos are typical pixel-based images.



General Image Types



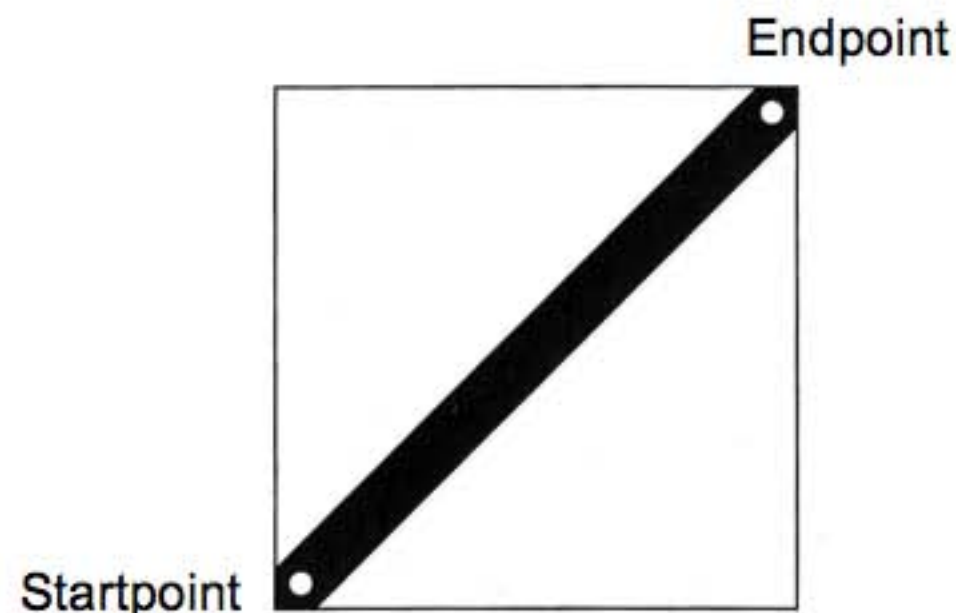
• Vector-based image :



In **vector art** the line is defined by **2 points**.

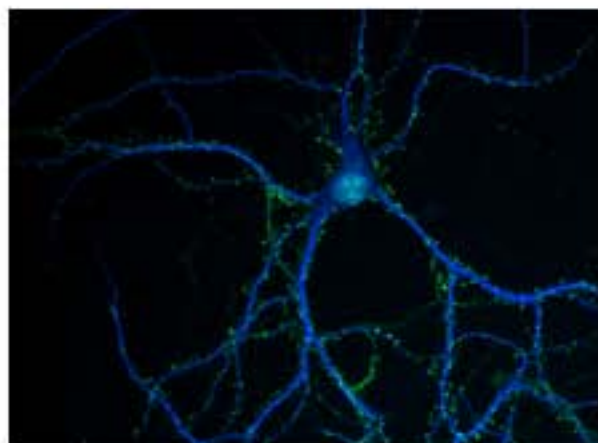
Storing info:

- X and Y of each point
- color of line, width



A 2 point vector line

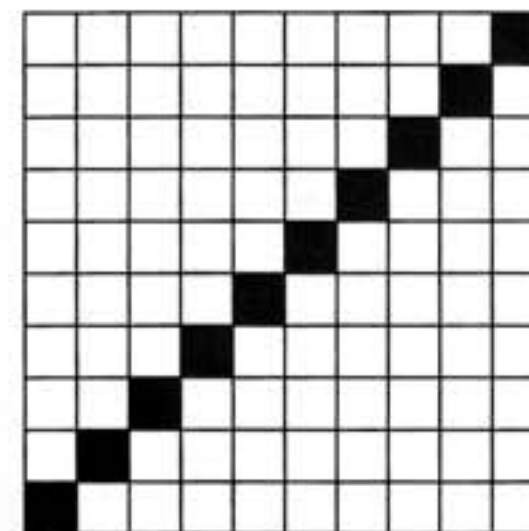
• Pixel-based image = bitmap = raster art :



In **pixel art** the line consists of **many points** of a particular color.

Storing info:

- color of each point of the grid
- size of the image 10x10 or 100x100 ?
- this values increase with size



A 100-pixel (10x10) line



General Image Types



• Vector-based image :



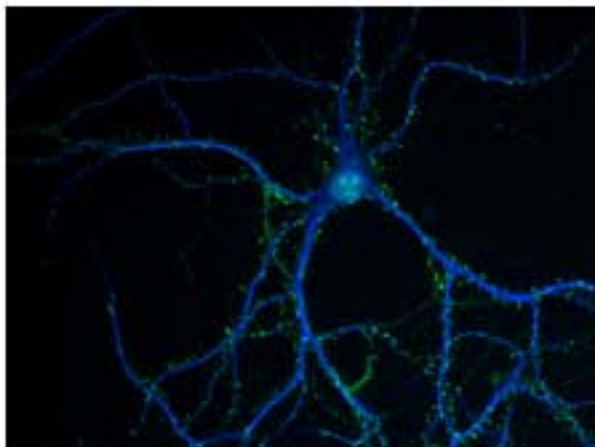
In **vector art** the file format can be :

- pdf : portable document format (Adobe)
- eps : encapsulated post-cript format (Adobe)
- svg : scalable vector graphics (XML)
- Ai: Adobe Illustrator



Vector art format

• Pixel-based image = bitmap = raster art :



In **pixel art** the file format can be :

- JPEG : Joint Photographic Expert Group (compressed)
- PNG : Portable Network Graphic (screen capture)
- TIFF : Tag Image File Format
- BMP: Bitmap (Microsoft, IBM)
- PSD : Adobe Photoshop



Pixel art format



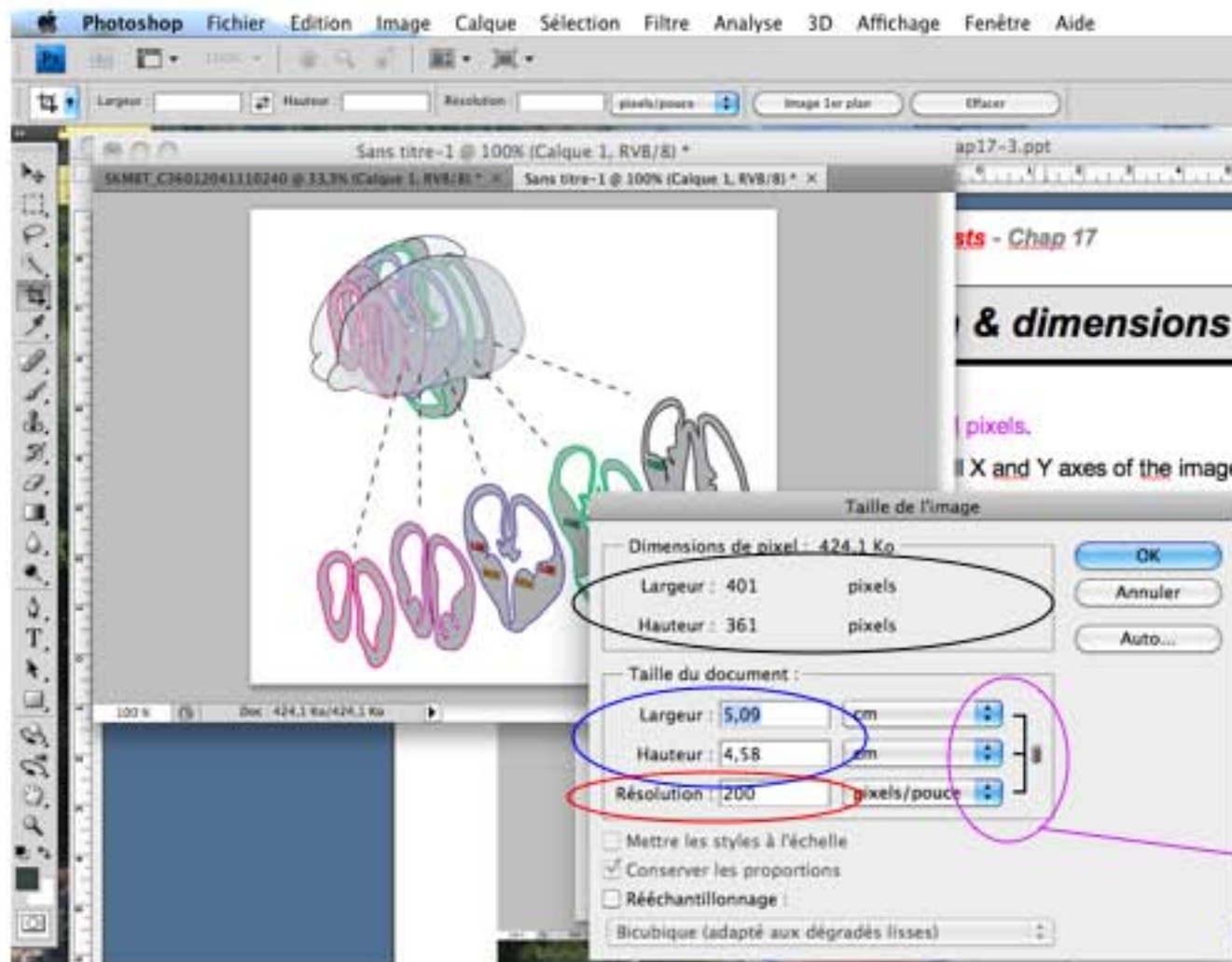
Image resolution & dimensions

In **pixel art** images are made up by a **grid of colored pixels**.

Pixel dimension: the **number of pixels** along the full X and Y axes of the image, for example 800 x 600 pixels.

Physical size: the size that the image appears **on a printed page**, such as 89 mm x 66 mm.

Resolution: the size of each pixel, expressed as the **number of pixels per unit of physical dimension**, usually called dots per inch (DPI) or pixel per inch (PPI).



Pixel size

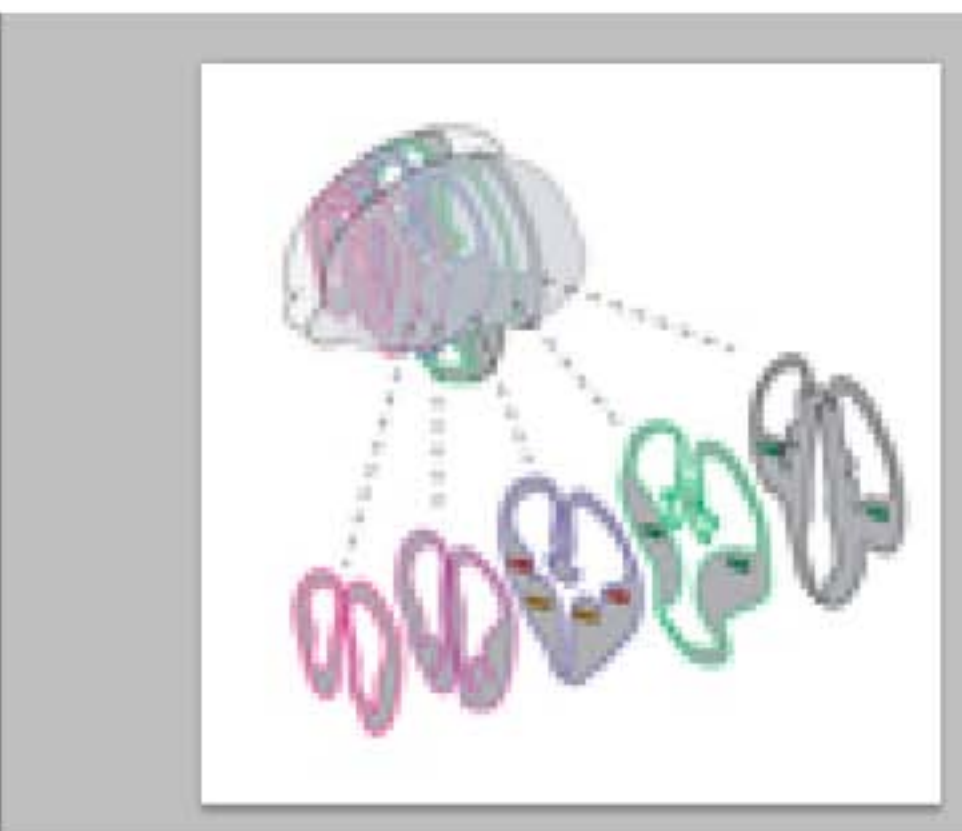
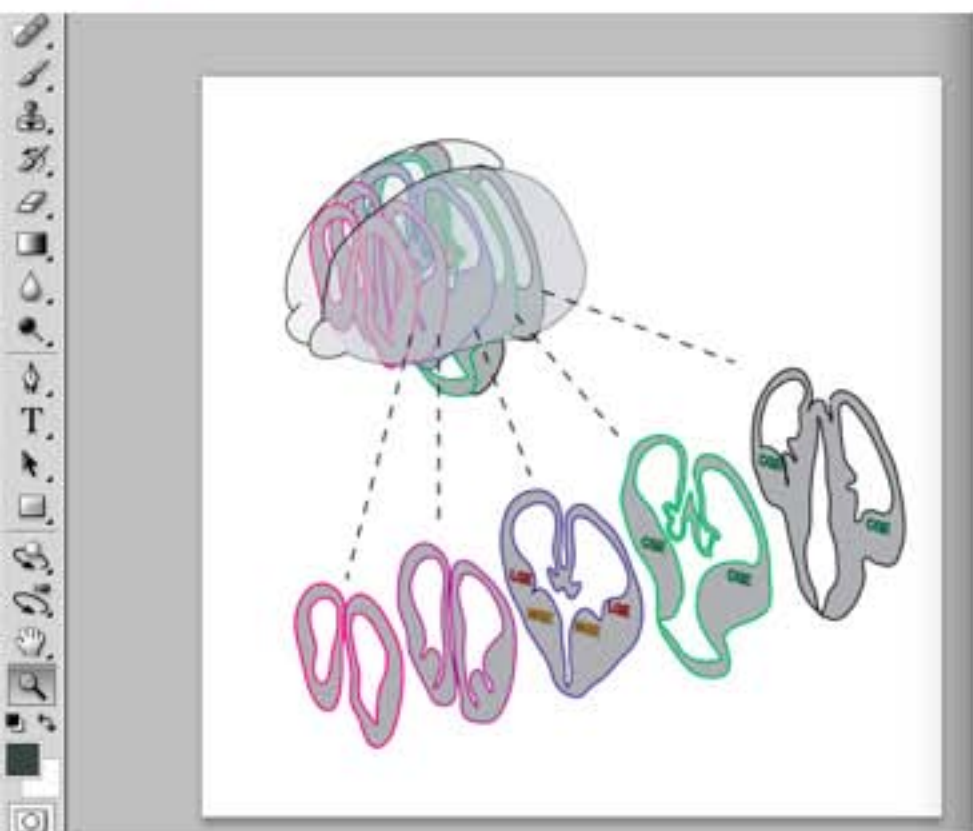
Physical size

Resolution

The 3 parameters are linked.

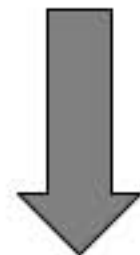


Image resolution & dimensions



Same physical size

Less pixels



Lower resolution

Taille de l'image

Dimensions de pixel : 468,8 Ko

Largeur : 400 pixels

Hauteur : 400 pixels

Taille du document :

Largeur : 5,08 cm

Hauteur : 5,08 cm

Résolution : 200 pixels/pouce

Mettre les styles à l'échelle

Conserver les proportions

Rééchantillonnage :

Bicubique (adapté aux dégradés lisses)

OK

Annuler

Auto...

Taille de l'image

Dimensions de pixel : 29,3 Ko

Largeur : 100 pixels

Hauteur : 100 pixels

Taille du document :

Largeur : 5,08 cm

Hauteur : 5,08 cm

Résolution : 50 pixels/pouce

Mettre les styles à l'échelle

Conserver les proportions

Rééchantillonnage :

Bicubique (adapté aux dégradés lisses)

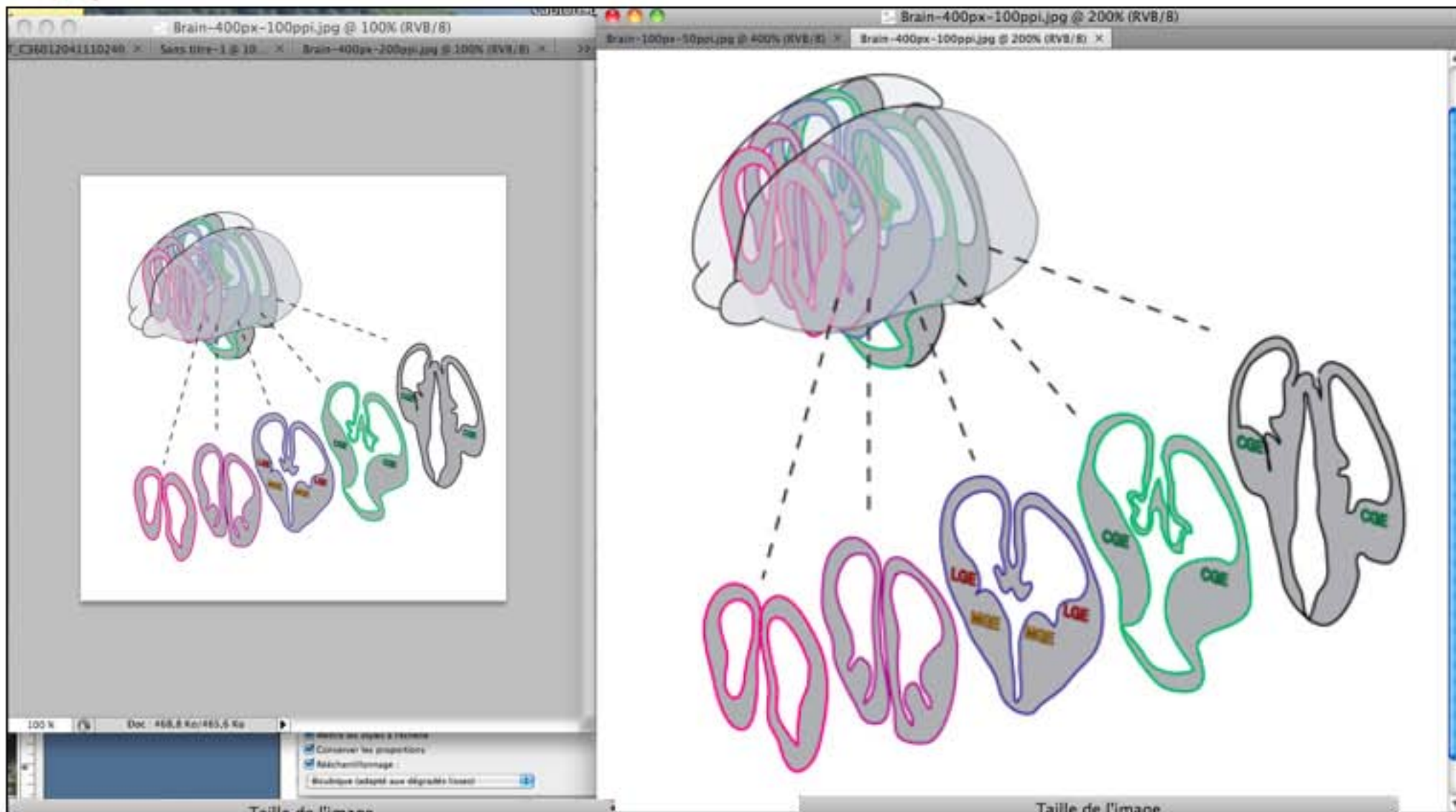
OK

Annuler

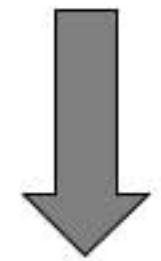
Auto...



Image resolution & dimensions



Bigger physical size
same pixels



Lower resolution

Taille de l'image

Dimensions de pixel : 468,8 Ko

Largeur : 400 pixels

Hauteur : 400 pixels

Taille du document :

Largeur : 5,08 cm

Hauteur : 5,08 cm

Résolution : 200 pixels/pouce

OK

Annuler

Auto...

Taille de l'image

Dimensions de pixel : 468,8 Ko

Largeur : 400 pixels

Hauteur : 400 pixels

Taille du document :

Largeur : 10 cm

Hauteur : 10 cm

Résolution : 101,6 pixels/pouce

OK

Annuler

Auto...



Deciding between vector & pixels



• Vector-based image :



- you can zoom and enlarge drawing without pixelization (open AI and PS)
- Text is searchable
- Everything is easily editable (annotations, arrows, color)
- You can convert vector to pixel art, (difficult in the other way)

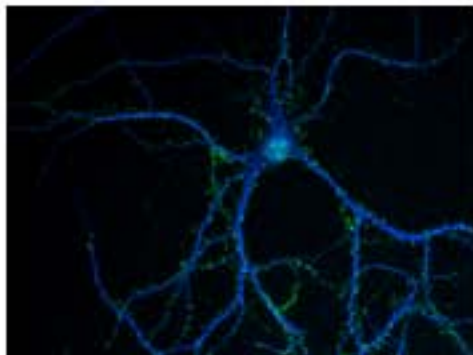
→ *Graphical elements should be created with vector art*



Vector art format

Ex: Adobe Illustrator

• Pixel-based image = bitmap = raster art :



- The pixellization rendering depends on resolution
- Requires thousands times more memory
- Pixel text is not searchable
- Pixel text can not be easily copied and pasted
- But Contained complex info sometimes hard to represent line-by-line (photo, gels)
- For plots with thousands of data points, vector objects become cumbersome.

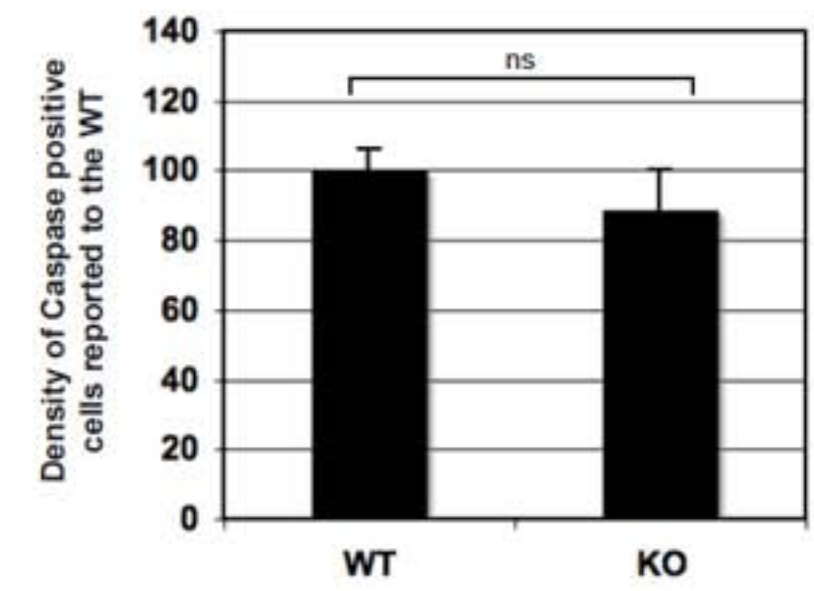
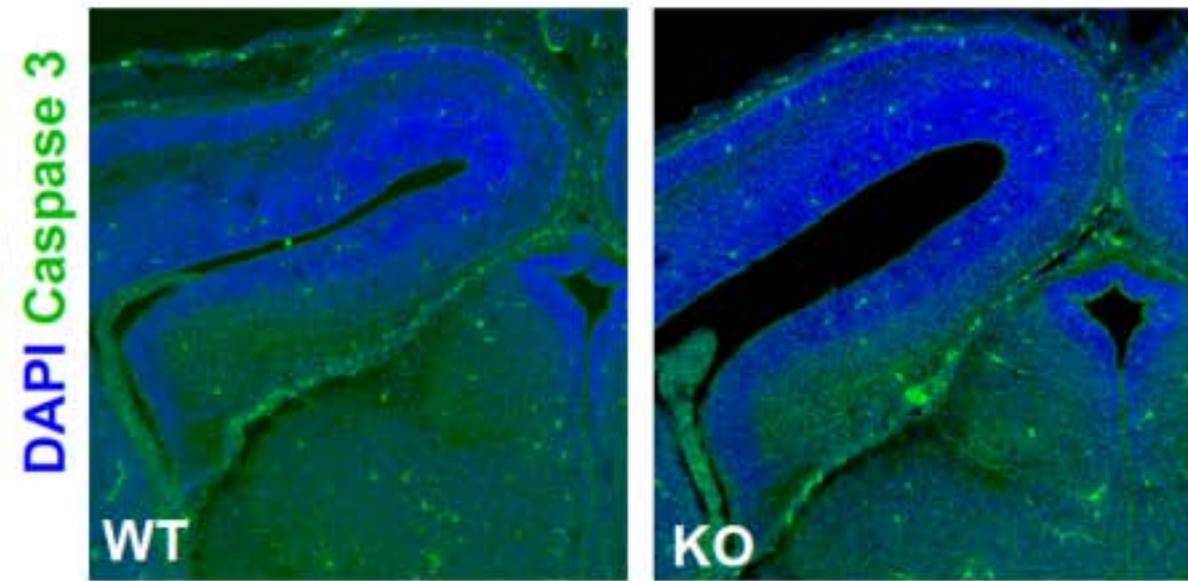
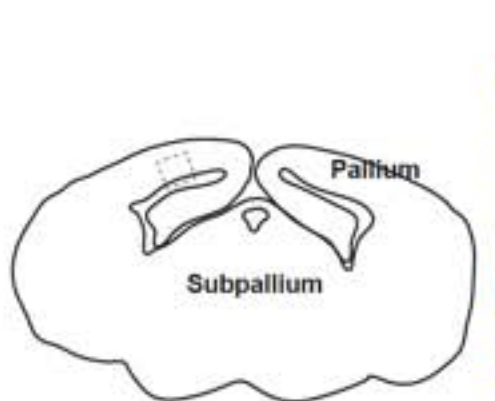
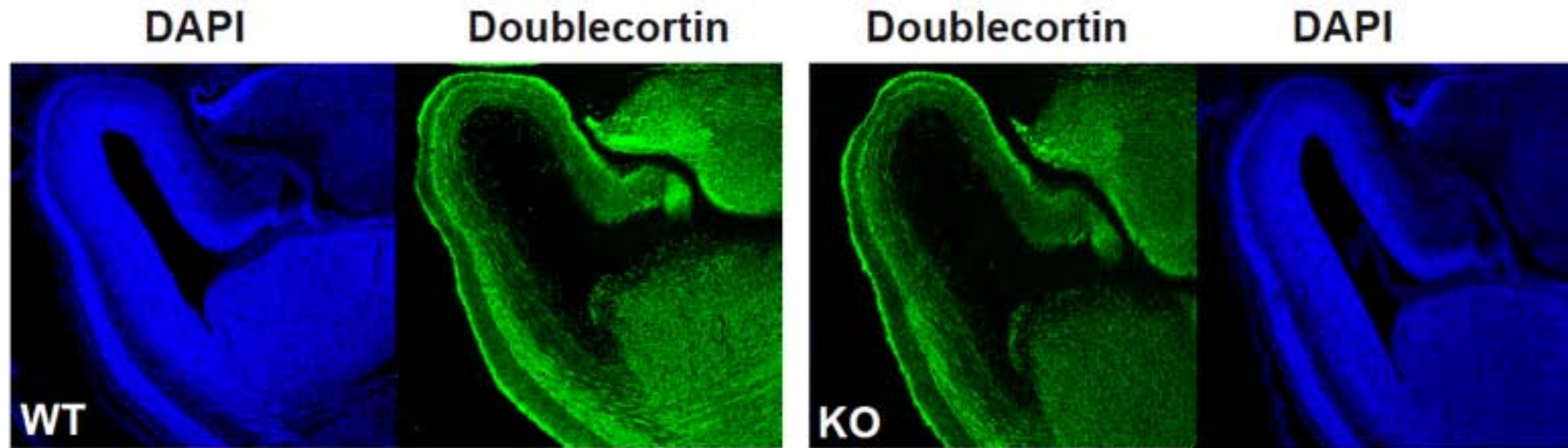


Pixel art format

Adobe Photoshop



Combining vector & pixels



- Graphical elements and annotations should be kept with vector art (editable, scalable).
- Most vector file format (such as PDF) allow importation of photos, which will be embedded in file.



Using layers ...

- Vector-based image (on Illustrator) :

The screenshot shows the Adobe Illustrator interface with a scientific figure titled 'Layers.ai' at 150% zoom. The figure is divided into two main panels, B and D.

Panel B: Shows a diagram of EGF receptor internalization and two line graphs. The diagram illustrates EGF binding to its receptor at 18°C, followed by acid wash at 4°C, and then time points (0, 15, 30, 60, and 120 min) at 37°C. The graphs show the 'Kinetics of intracellular EGF' for EGF-A488. The top graph shows a decrease in intracellular EGF over time for Mock siRNA (circles), TI-VAMP siRNA 1 (triangles), and TI-VAMP siRNA 2 (inverted triangles). The bottom graph shows a similar trend.

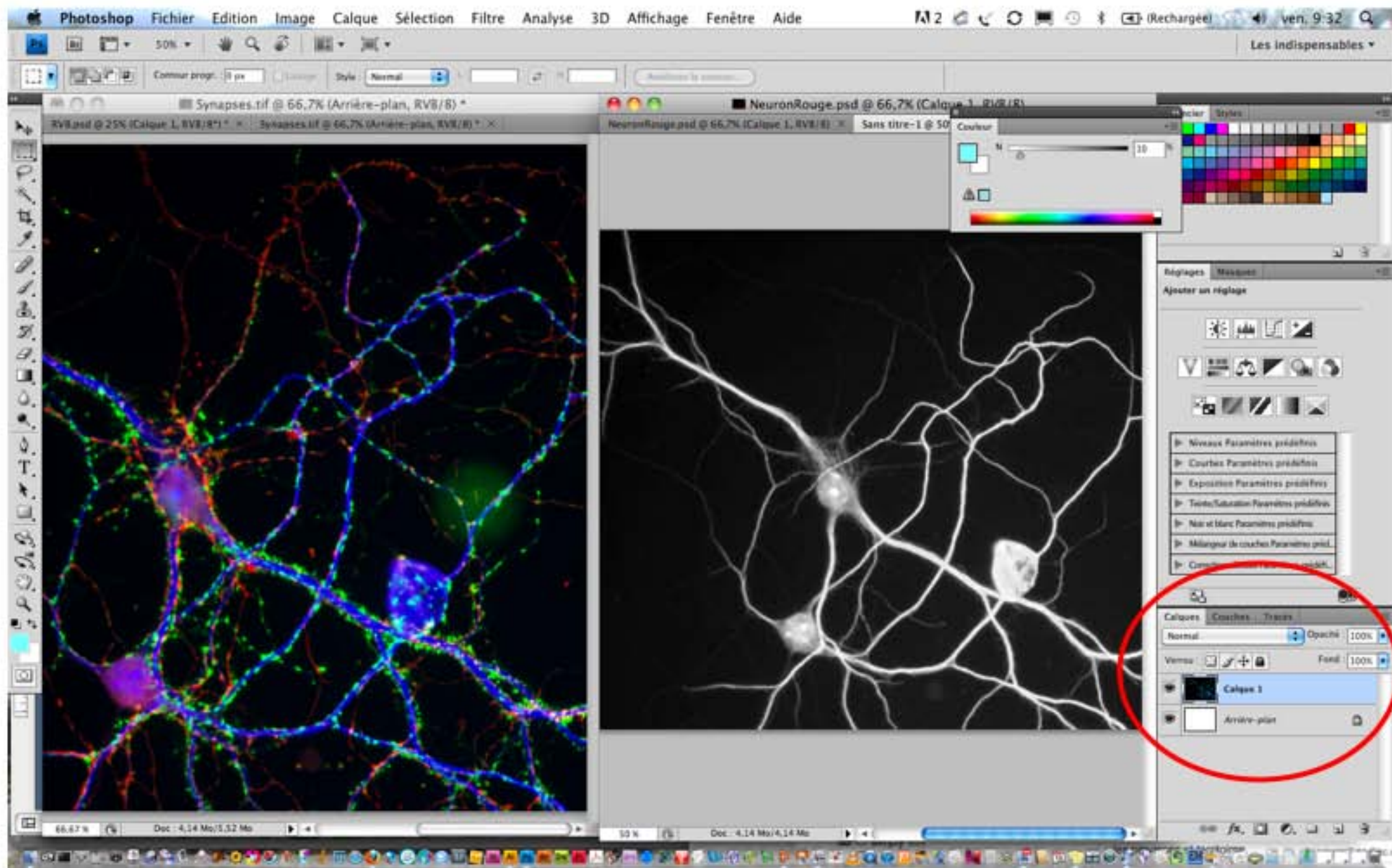
Panel D: Shows a similar diagram but with a 2-hour time point at 37°C. Below it is a bar graph titled 'EGF-A488' showing 'Intracellular EGF normalized to t=0'. The x-axis lists siRNA treatments: Mock, TI-VAMP siRNA 1, TI-VAMP siRNA 2, VAMP3, VAMP4, and VAMP8. The y-axis ranges from 0 to 100. Error bars are shown for each bar.

A red circle highlights the 'Calques' (Layers) panel on the right side of the interface, which shows a list of layers for the document.



Using layers ...

- Pixel-based image (on Photoshop) :





Postscript files & rasterization



Rasterization

Postscript file (EPS)

Conversion to pixel image

Imposed final size

(Print to file or Acrobat distiller)



Vector art format
Ex: Adobe Illustrator

10 x 15cm or Poster ?



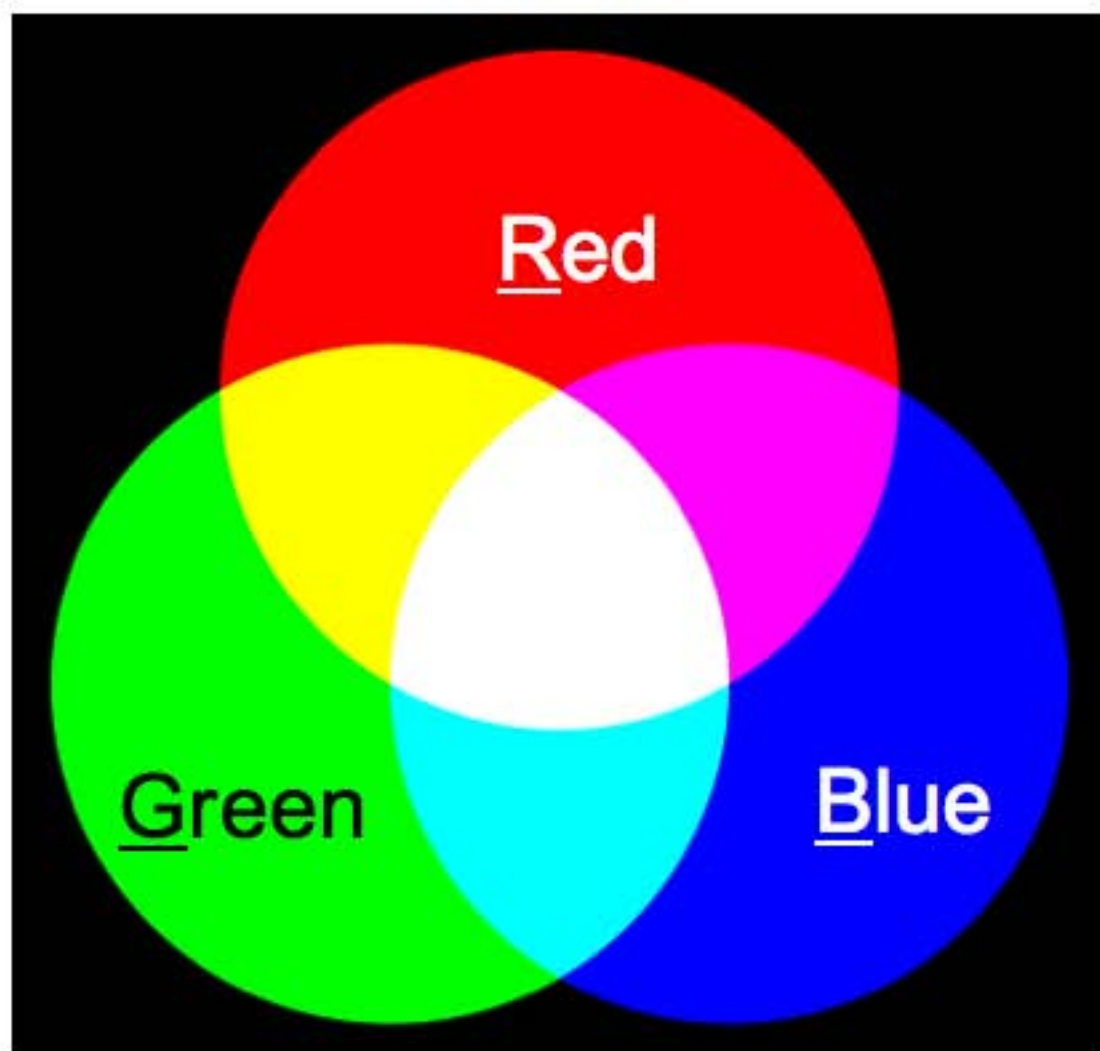


Color models & color space

Additive synthesis

Based on addition of light

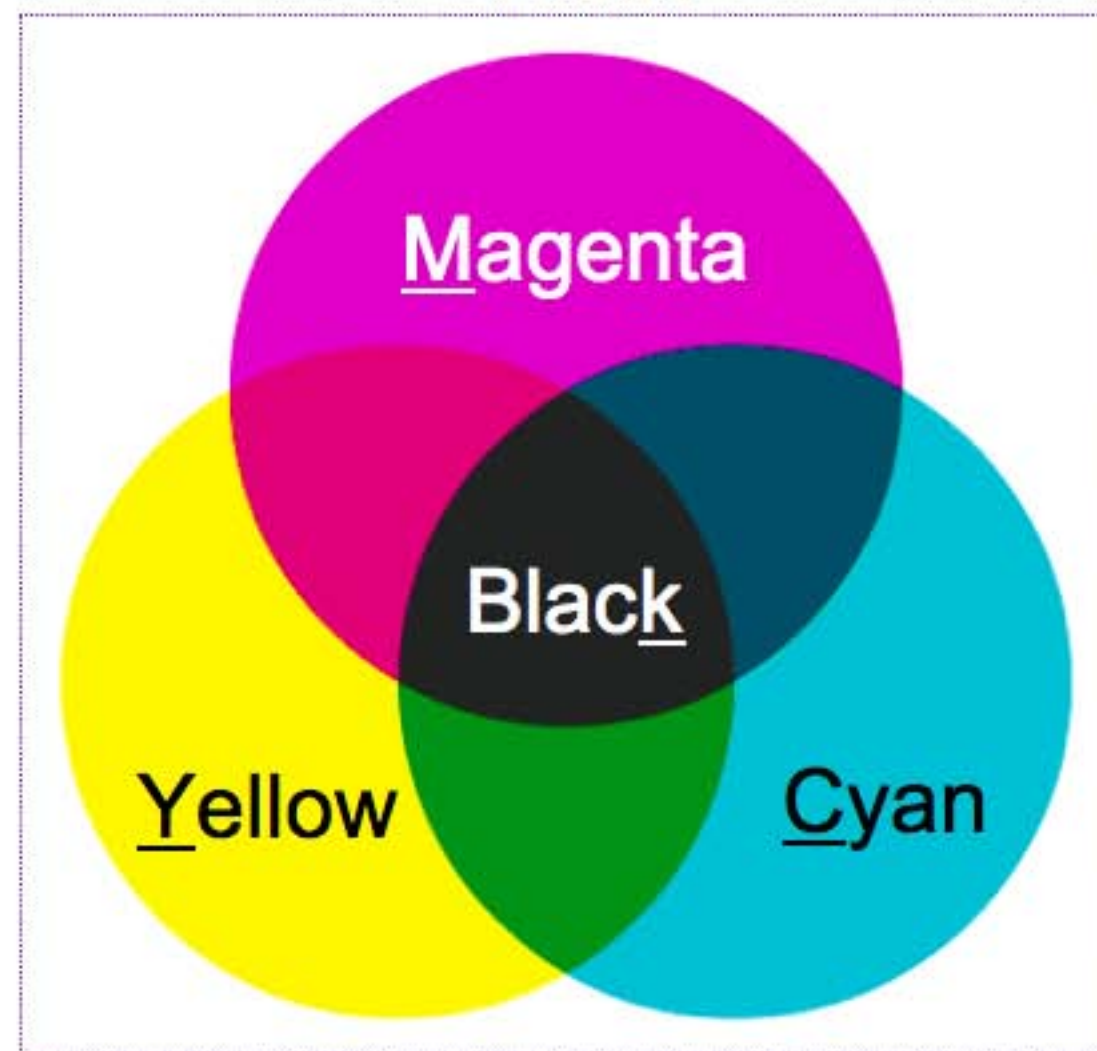
RGB



Subtractive synthesis

Based on absorption of pigments

CMYK



- in RGB: increasing value correspond to brighter pixels thus lighter color (White in center)
- in CMYK: increasing values represent more ink, thus darker (black in the center)



Color models & color space

Additive synthesis

Based on addition of light

RGB

screen / projectors



Light



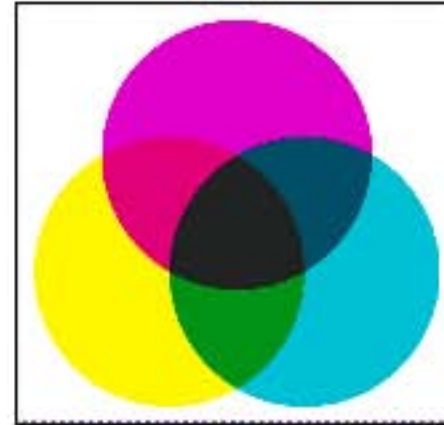
Subtractive synthesis

Based on absorption of pigments

CMYK

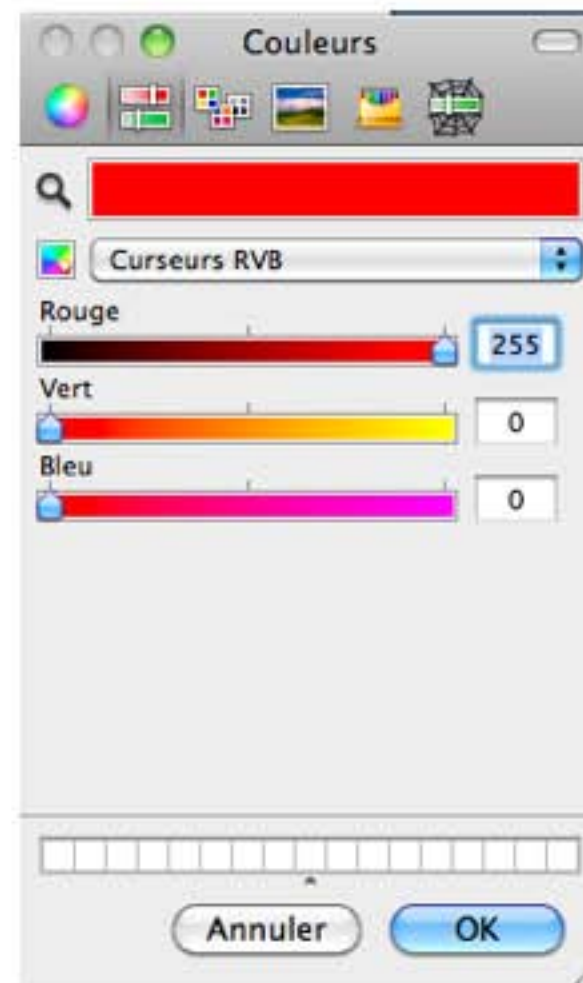
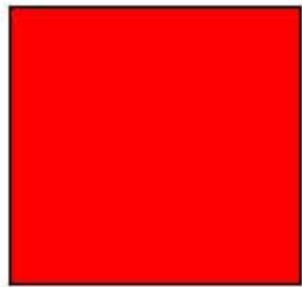
Press - printers

Ink





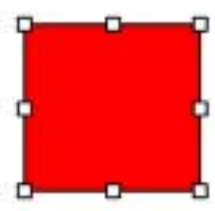
Color models & color space





Practical computing for biologists - Chap 17

Color models & color space



Couleurs

Annuler OK

Couleurs

curseurs RVB

Rouge: 255
Vert: 0
Bleu: 0

Annuler OK

Couleurs

Palette: Apple

- Noir
- Bleu
- Brun
- Cyan
- Vert
- Magenta
- Orange
- Violet
- Rouge
- Jaune
- Blanc

Annuler OK

Couleurs

Image: Spectre

Annuler OK

Couleurs

Annuler OK

Couleurs

FF0000

Rouge: FF
Vert: 00
Bleu: 00

Couleurs Web seulement

Annuler OK

Aucun remplissage

Automatique

Choisir la couleur du remplissage

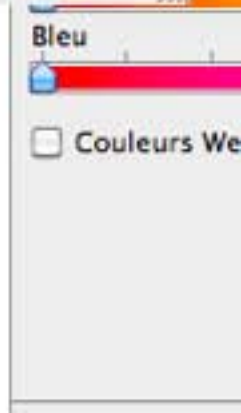
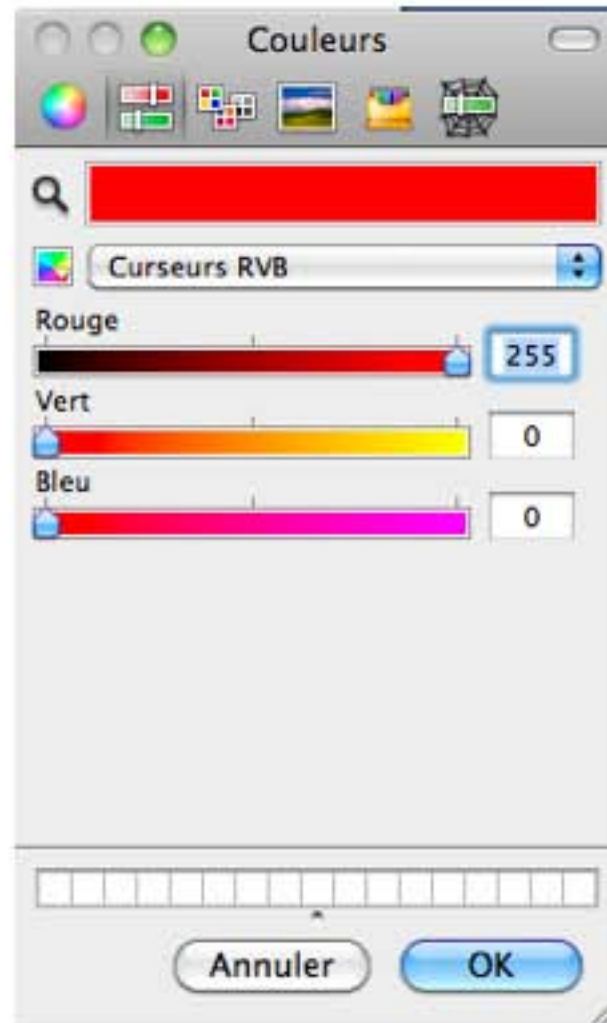
Autres couleurs... Choisir la couleur du remplissage

Motifs et textures...





Color models & color space





Color models & color space

RVB

Curseurs RVB

Rouge: 255

Vert: 0

Bleu: 0

CMYK

Curseurs CMJN

Cyan: 0 %

Magenta: 100 %

Jaune: 100 %

Noir: 0 %

TSL

Curseurs TSL

Teinte: 353 °

Saturation: 43 %

Luminosité: 100 %

Hexadecimal (Web)

FF0000

Rouge: FF

Vert: 00

Bleu: 00

Couleurs Web seulement



Color models & color space

The screenshot shows the Adobe Photoshop interface. The main canvas displays a color wheel with three overlapping circles: red, green, and blue. The 'Couleur' (Color) panel is open, showing RGB sliders and a color bar. A context menu is open over the color wheel, listing various color models and options. The 'Niveaux de gris' (Grayscale) section is expanded, showing 'RVB' (RGB) as the selected option, along with 'TSL', 'CMJN', 'Lab', and ' curseurs de couleurs Web'. Other options include 'Copier la couleur en HTML', 'Spectre RVB', 'Spectre CMJN', 'Echelle de gris', 'Couleurs courantes', 'Protéger la gamme Web', 'Fermer', and 'Fermer le groupe d'onglets'. The 'Calques' (Layers) panel on the right shows 'Calque 1' (Layer 1) and 'Arrière-plan' (Background). The status bar at the bottom indicates 'Diapositive 1 sur 1' (Slide 1 of 1).

ez pour ajout

ez pour ajouter un sous-titre

Cliquez pour ajouter des commentaires

Diapositive 1 sur 1



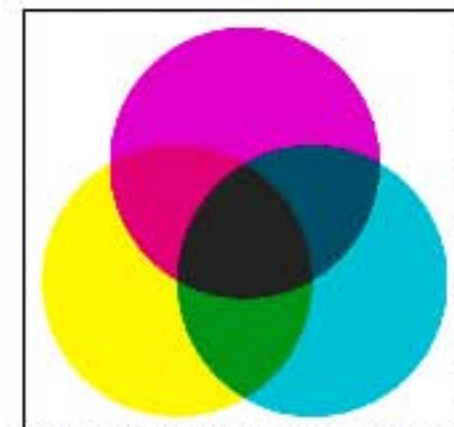
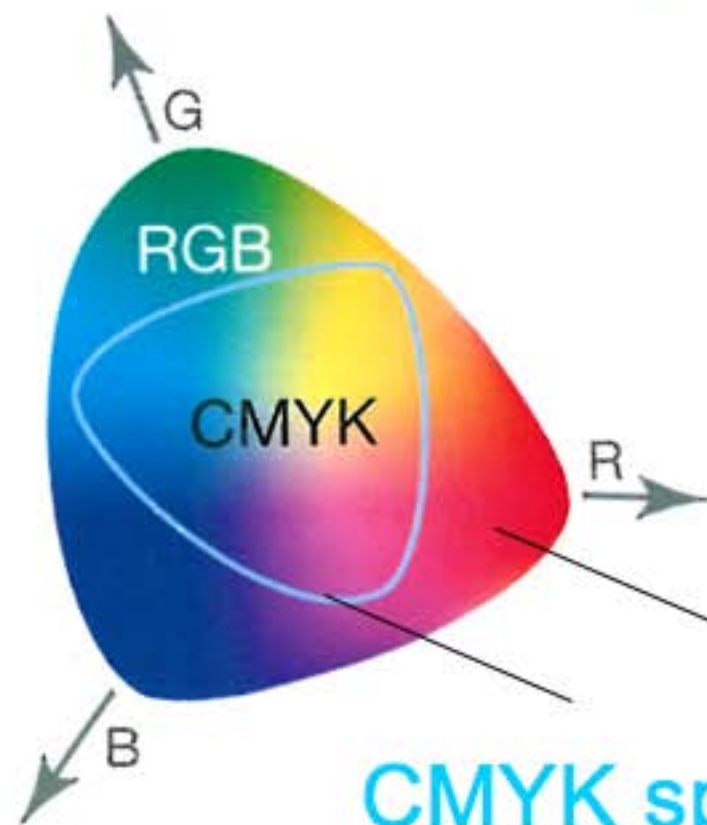
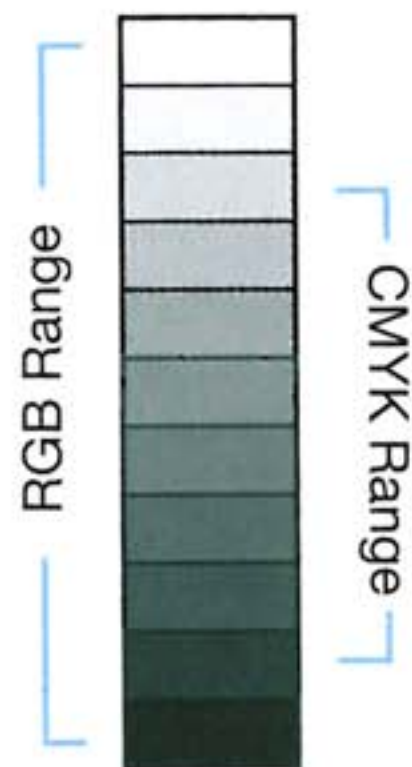
Color models & color space

RGB

screen / projectors

CMYK

Press - printers



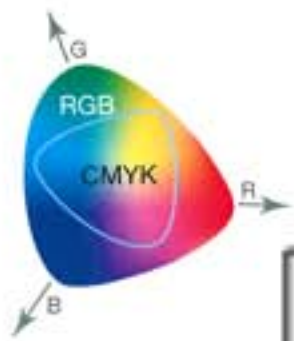
RGB space

CMYK space

- RGB describes a larger portion of color space than does CMYK
- That the reason why it's hard to convert RGB to CMYK



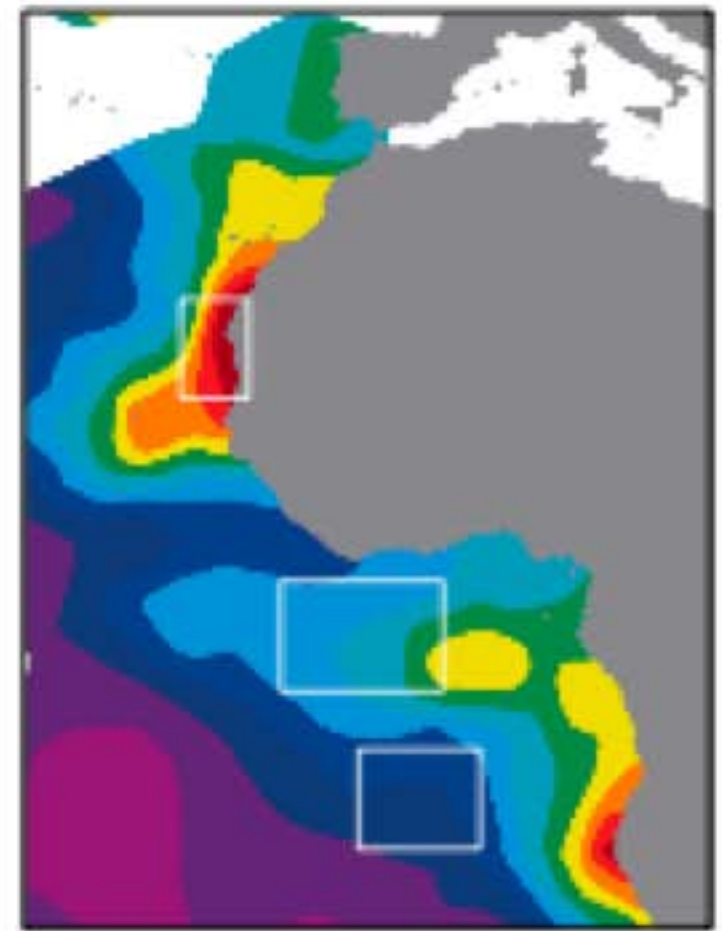
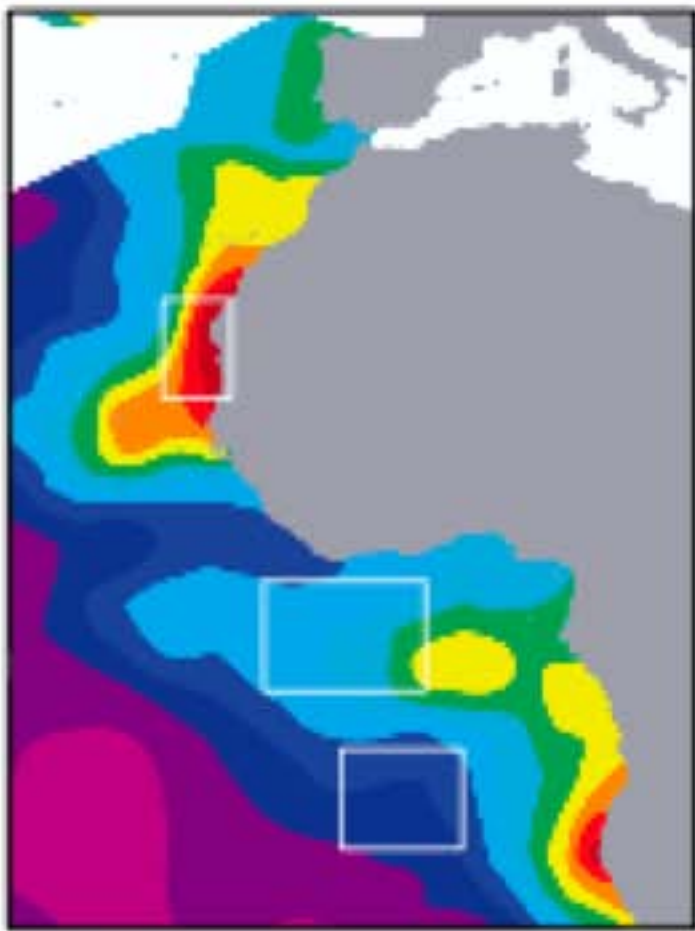
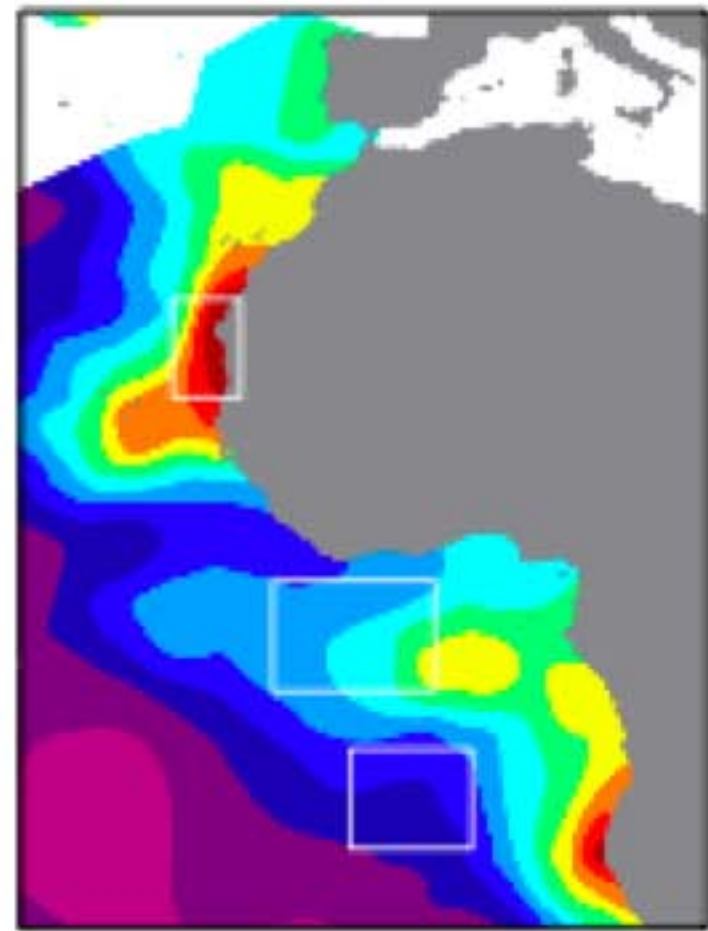
Color models & color space



RGB
(Screen)

CMYK
coated paper
(journal)

CMYK
uncoated paper
(laser printer)



- RGB describes a larger portion of color space than does CMYK
- information about the oceanographic features in white boxes are lost in CMYK.



Color choices

At least **7% of males** have some degree of **color blindness**, which affects the ability to tell red and green apart. For this reason, you should avoid using red, and replace it by magenta.

Firefox Fichier Édition Affichage Historique Marque-pages Outils Fenêtre Aide

Vischeck: Home

vischeck.com

Google Home - PubMed... BiblioSERM Biblio Fournisseurs UJM/PRC BM Seurs Grant Pratic Inserm concours Imagerie

Vischeck **Your brain, just brighter**

Speed Memory
Attention Problem Solving
Flexibility

Start Training ▶

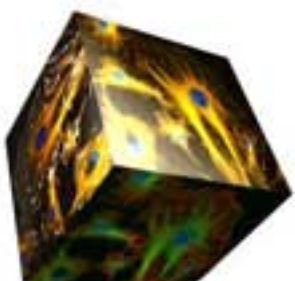
lumosity

Home
[Vischeck](#)
[Daltonize](#)
[Examples](#)
[Downloads](#)
[Info & Links](#)
[FAQ](#)
[About Us](#)

User quotes:
I just wanted to let you know I think your site is awesome. As a high school student, I've never really told anyone that I was colourblind - until it was brought up in a biology class. Being the curious folks, high school students are, I was bombarded by "what colour is this, what colour is this?" and "what *can* you see?". Thanks to your site, I can actually show them what it's like to be colourblind, plus explaining some facts to me. Just wanted to show my appreciation,
-Paul P.

Vischeck simulates colorblind vision.

Daltonize corrects images for colorblind viewers.



How do babies see the world? Visit [TinyEyes](#).

Other sites worth visiting:
[Treatment Eating Disorder Center](#)
[Italy villas & apartments](#)
[add url](#)

http://jeux-flash.jeu-gratuit.net/jeux_pour/test-daltonien-1844.html



Color choices

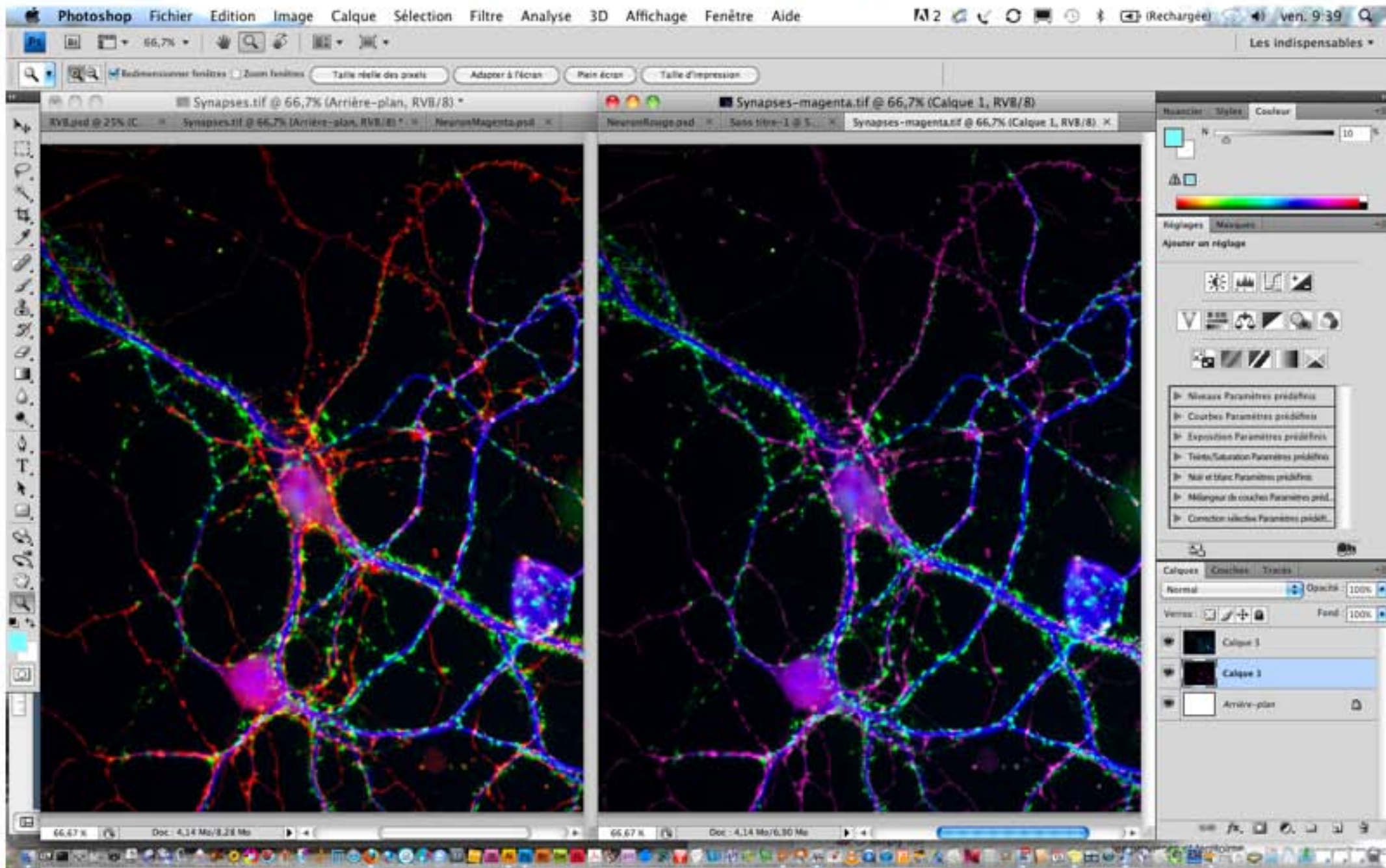
At least **7% of males** have some degree of **color blindness**, which affects the ability to tell red and green apart. For this reason, you should avoid using red, and replace it by magenta.

A screenshot of a web browser displaying the Vischeck website. The browser window shows the URL 'vischeck.com/vischeck/vischeckImage.php?&img1=uploads%2Fvc_tzESGL_orig.jpg&img2=uploads%2Fvc_tzESGL_sim.jpg&simTyp'. The website header includes the Vischeck logo and a navigation menu with options like 'Speed', 'Memory', 'Attention', 'Problem Solving', and 'Flexibility'. The main content area is titled 'Try Vischeck on Your Image Files' and shows 'Your Results:' with three side-by-side images: 'Original Image', 'Deuteranope Simulation', and 'Protanope Simulation'. The 'Original Image' shows a complex network of biological structures with various colors. The 'Deuteranope Simulation' shows the same image with red and green colors swapped or muted. The 'Protanope Simulation' shows the image with red and green colors further altered. Below the images, there is a section titled 'Select the type of color vision to simulate:' with two radio button options: 'Deuteranope (a form of red/green color deficit)' and 'Protanope (another form of red/green color deficit)'. The 'Deuteranope' option is selected.



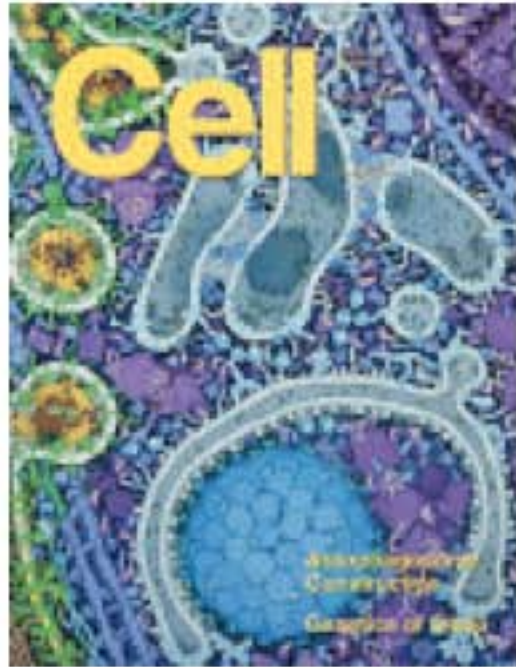
Color choices

At least **7% of males** have some degree of **color blindness**, which affects the ability to tell red and green apart. For this reason, you should avoid using red, and replace it by magenta.





Converting *RGB* to *CMYK* to publish



RGB
(Screen)



CMYK
coated paper
(paper copy)



- Select color mode (RGB)
- Attribute a profile (Adobe RGB 1998)
- Use the command convert to profile (RGB -> CMYK)

Converting RGB to CMYK to publish

Photoshop

Fichier Edition Image Calque Sélection Filtre Analyse 3D Affichage Fenêtre Aide

25% Contour pr

Annuler ⌘Z
Aller vers l'avant ⇧⌘Z
Aller vers l'arrière ⌘Z
Atténuer... ⇧⌘F
Couper ⌘X
Copier ⌘C
Copier avec fusion ⇧⌘C
Coller ⌘V
Coller dedans ⇧⌘V
Effacer
Orthographe...
Rechercher et remplacer du texte...
Remplir... ⇧F5
Contour...
Echelle basée sur le contenu
Transformation manuelle ⌘T
Transformation
Alignement automatique des calques...
Fusion automatique des calques...
Définir une forme prédéfinie...
Utiliser comme motif...
Créer une forme personnalisée...
Purger
Paramètres prédéfinis Adobe PDF...
Gestionnaire des paramètres prédéfinis...
Couleurs... ⇧⌘K
Attribuer un profil...
Convertir en profil...
Raccourcis clavier... ⌘⇧⌘K
Menus... ⌘⇧⌘M

Couleur

N 10 %

CMYK to publish

CMYK coated paper (paper copy)

than does CMYK

graphic features in white boxes are lost in CMYK.

Nuancier Styles

Réglages Masques

Ajouter un réglage

Niveaux Paramètres prédéfinis
Courbes Paramètres prédéfinis
Exposition Paramètres prédéfinis
Teinte/Saturation Paramètres prédéfinis
Noir et blanc Paramètres prédéfinis
Mélangeur de couches Paramètres prédéfinis
Correction sélective Paramètres prédéfinis

Calques Couches Tracés

Normal Opacité 100%

Verrou : Fond : 100%

Calque 1

Arrrière-plan

Diapositive 22 sur 2

Converting RGB to CMYK to publish

Photoshop Fichier Edition Image Calque Sélection Filtre Analyse 3D Affichage Fenêtre Aide

RVB.psd @ 25% (Calque 1, RVB/8*)

Couleurs

! Pour plus d'informations sur les paramètres de couleur, recherchez "configuration de la gestion des couleurs" dans l'Aide à partir de n'importe quelle application de Creative Suite.

Paramètres : **Personnalisés**

Espaces de travail

RVB : sRGB IEC61966-2.1

CMJN : Coated FOGRA27 (ISO 12647-2:2004)

Niveaux de gris : Dot Gain 15%

Ton direct : Dot Gain 15%

Règles de gestion des couleurs

RVB : Désactivées

CMJN : Conserver les profils incorporés

Niveaux de gris : Conserver les profils incorporés

Non-concordances des profils : Choix à l'ouverture Choix au collage

Profils manquants : Choix à l'ouverture

Description

Espaces de travail : l'espace de travail désigne le profil colorimétrique de travail de chaque modèle de couleur (façon dont les valeurs numériques d'une couleur correspondent à son aspect visuel). L'espace de travail est utilisé pour les documents sans gestion des couleurs et ceux nouvellement créés avec gestion des couleurs.

OK

Annuler

Charger...

Enregistrer...

Plus d'options

Aperçu

Nuancier Styles

Réglages Masques

Ajouter un réglage

Niveaux Paramètres prédéfinis

Courbes Paramètres prédéfinis

Exposition Paramètres prédéfinis

Teinte/Saturation Paramètres prédéfinis

Noir et blanc Paramètres prédéfinis

Mélangeur de couches Paramètres prédéfinis

Correction sélective Paramètres prédéfinis

Calques Couches Traces

Normal Opacité 100%

Fond 100%

Calque 1

Arrière-plan

Doc : 15,3 Mo/6,41 Mo

Diapositive 24 sur 2

Converting RGB to CMYK to publish

Photoshop Edition Image Calque Sélection Filtre Analyse 3D Affichage Fenêtre Aide

Annuler ⌘Z
Aller vers l'avant ⌘⇧Z
Aller vers l'arrière ⌘⇧⌘Z
Atténuer... ⌘⇧F
Couper ⌘X
Copier ⌘C
Copier avec fusion ⌘⇧C
Coller ⌘V
Coller dedans ⌘⇧V
Effacer
Orthographe...
Rechercher et remplacer du texte...
Remplir... ⌘F5
Contour...
Echelle basée sur le contenu
Transformation manuelle ⌘T
Transformation
Alignement automatique des calques...
Fusion automatique des calques...
Définir une forme prédéfinie...
Utiliser comme motif...
Créer une forme personnalisée...
Purger
Paramètres prédéfinis Adobe PDF...
Gestionnaire des paramètres prédéfinis...
Couleurs... ⌘K
Attribuer un profil...
Convertir en profil...
Raccourcis clavier... ⌘⇧K
Menus... ⌘⇧M

Couleur

CMYK to publish

CMYK coated paper (paper copy)

than does CMYK

graphic features in white boxes are lost in CMYK.

Nuancier Styles

Réglages Masques

Ajouter un réglage

Niveaux Paramètres prédéfinis
Courbes Paramètres prédéfinis
Exposition Paramètres prédéfinis
Teinte/Saturation Paramètres prédéfinis
Noir et blanc Paramètres prédéfinis
Mélangeur de couches Paramètres prédéfinis
Correction sélective Paramètres prédéfinis

Calques Couches Traces

Normal Opacité 100%

Verrou : Fond : 100%

Calque 1
Arrière-plan

Diapositive 22 sur 2

Converting RGB to CMYK to publish

Photoshop Edition Image Calque Sélection Filtre Analyse 3D Affichage Fenêtre Aide

Annuler ⌘Z
Aller vers l'avant ⌘⇧Z
Aller vers l'arrière ⌘⇧⌘Z
Atténuer... ⌘⇧F
Couper ⌘X
Copier ⌘C
Copier avec fusion ⌘⇧C
Coller ⌘V
Coller dedans ⌘⇧V
Effacer
Orthographe...
Rechercher et remplacer du texte...
Remplir... ⌘F5
Contour...
Echelle basée sur le contenu
Transformation manuelle ⌘T
Transformation
Alignement automatique des calques...
Fusion automatique des calques...
Définir une forme prédéfinie...
Utiliser comme motif...
Créer une forme personnalisée...
Purger
Paramètres prédéfinis Adobe PDF...
Gestionnaire des paramètres prédéfinis...
Couleurs... ⌘K
Attribuer un profil...
Convertir en profil...
Raccourcis clavier... ⌘⇧K
Menus... ⌘⇧M

Attribuer un profil

Attribuer un profil :
 Ne pas gérer les couleurs de ce document
 RVB de travail : sRGB IEC61966-2.1
 Profil : Adobe RGB (1998)

OK
Annuler
 Aperçu

than does CMYK
graphic features in white boxes are lost in CMYK.

Diapositive 22 sur 2

Converting RGB to CMYK to publish

Photoshop Edition Image Calque Sélection Filtre Analyse 3D Affichage Fenêtre Aide

Annuler ⌘Z
Aller vers l'avant ⇧⌘Z
Aller vers l'arrière ⇧⌘Z
Atténuer... ⇧⌘F
Couper ⌘X
Copier ⌘C
Copier avec fusion ⇧⌘C
Coller ⌘V
Coller dedans ⇧⌘V
Effacer
Orthographe...
Rechercher et remplacer du texte...
Remplir... ⇧F5
Contour...
Echelle basée sur le contenu
Transformation manuelle ⌘T
Transformation
Alignement automatique des calques...
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Paramètres prédéfinis Adobe PDF...
Gestionnaire des paramètres prédéfinis...
Couleurs... ⇧⌘K
Attribuer un profil...
Convertir en profil...
Raccourcis clavier... ⇧⌘K
Menus... ⇧⌘M

Couleur

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Noir et blanc Paramètres prédéfinis
Mélangeur de couches Paramètres prédéfinis
Correction sélective Paramètres prédéfinis

Calques Couches Traces

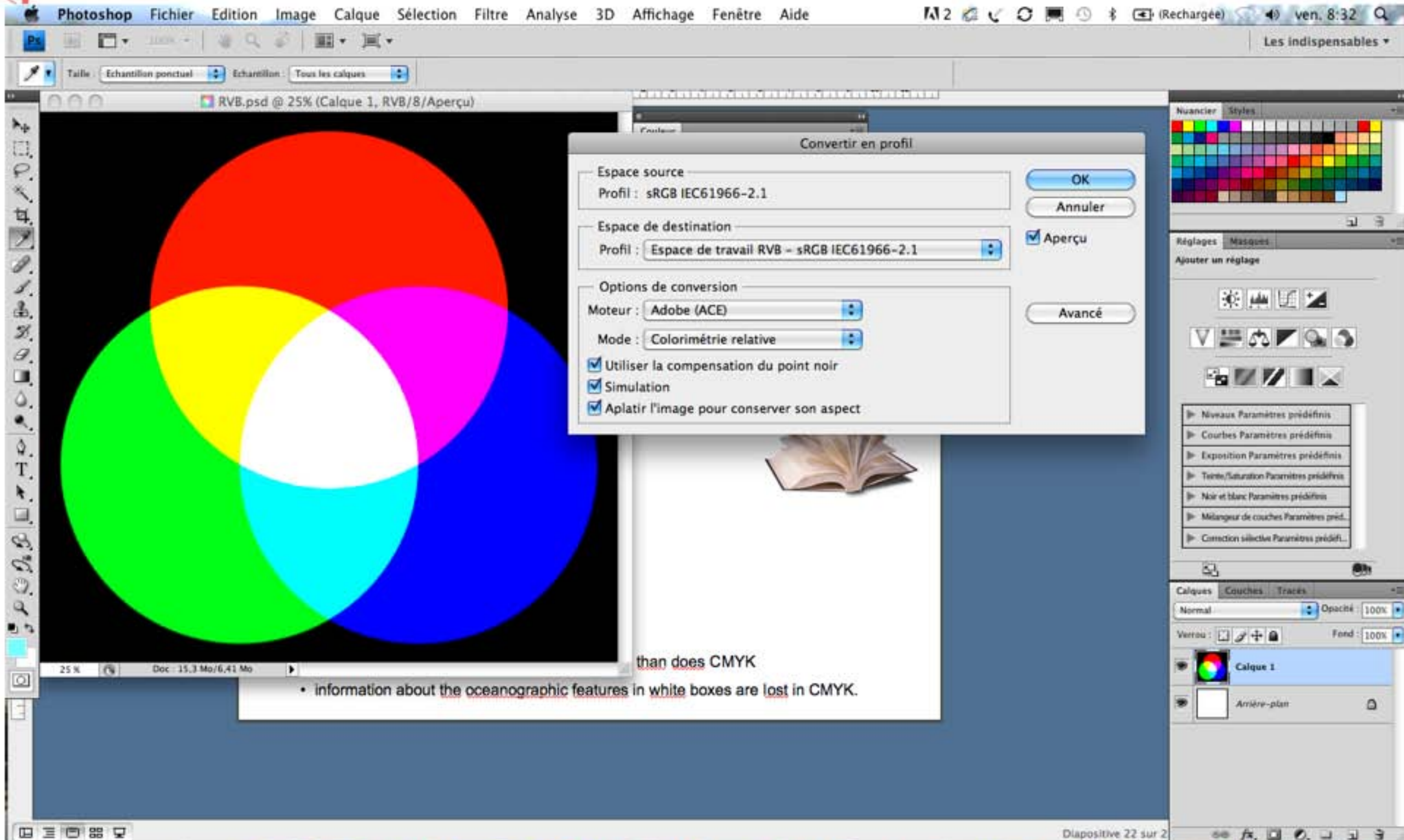
Normal Opacité 100%

Verrou Opacité 100%

Calque 1
Arrière-plan

Diapositive 22 sur 2

Converting RGB to CMYK to publish



The screenshot shows the Adobe Photoshop interface with the 'Convert to Profile' dialog box open. The dialog box is titled 'Convertir en profil' and contains the following settings:

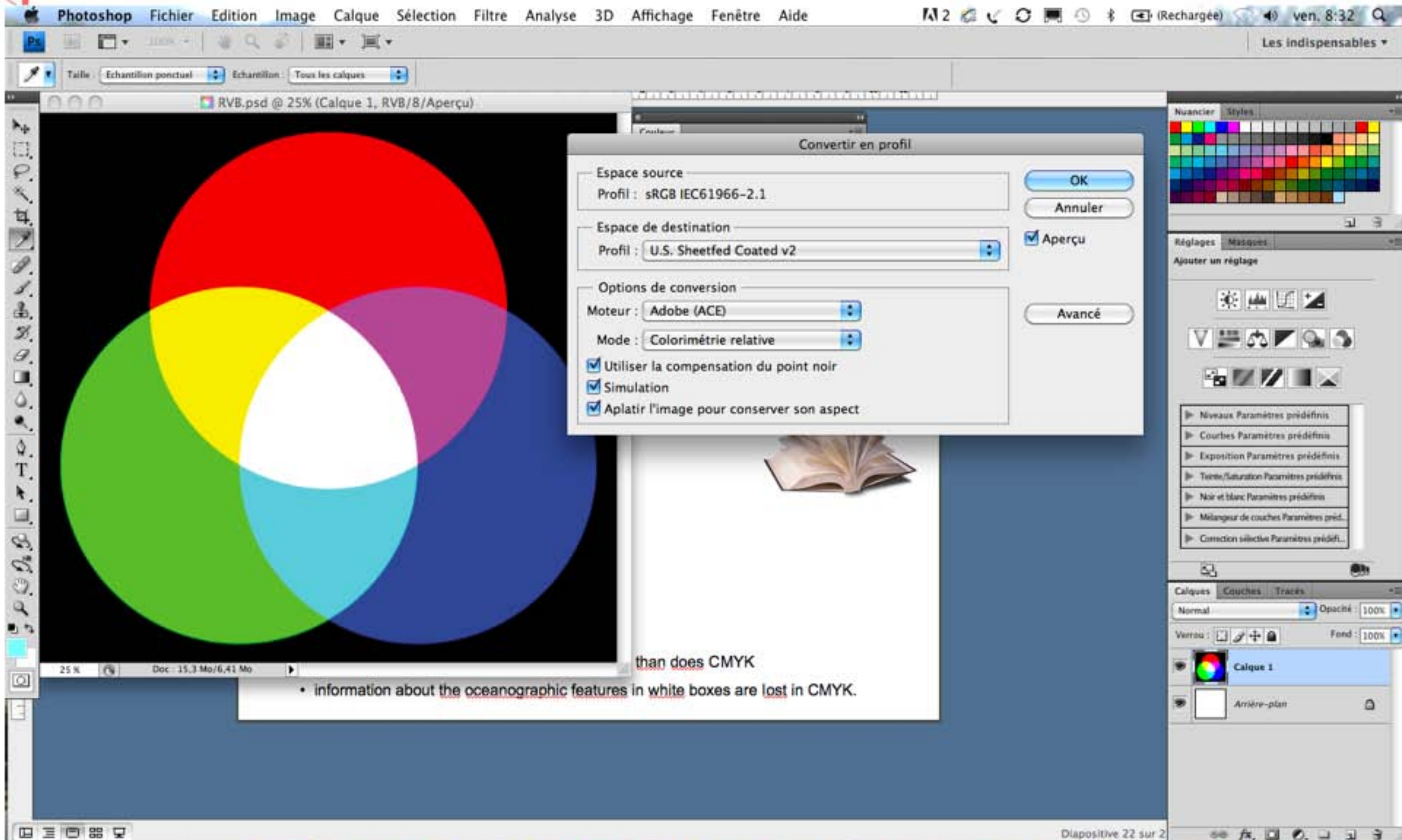
- Espace source: Profil : sRGB IEC61966-2.1
- Espace de destination: Profil : Espace de travail RVB - sRGB IEC61966-2.1
- Options de conversion:
 - Moteur : Adobe (ACE)
 - Mode : Colorimétrie relative
 - Utiliser la compensation du point noir
 - Simulation
 - Aplatis l'image pour conserver son aspect

Buttons on the right side of the dialog include 'OK', 'Annuler', 'Aperçu', and 'Avancé'. The background shows a color calibration chart with four overlapping circles (red, yellow, cyan, magenta) and a white center. The Photoshop interface includes the menu bar, toolbar, and various panels like 'Nuancier', 'Réglages', and 'Calques'.

than does CMYK

- information about the oceanographic features in white boxes are lost in CMYK.

Converting *RGB* to *CMYK* to publish



The screenshot shows the Adobe Photoshop interface with the 'Convertir en profil' dialog box open. The dialog box is centered over a color calibration chart (a Venn diagram of overlapping color circles). The dialog box has the following settings:

- Espace source: Profil : sRGB IEC61966-2.1
- Espace de destination: Profil : U.S. Sheetfed Coated v2
- Options de conversion:
 - Moteur : Adobe (ACE)
 - Mode : Colorimétrie relative
 - Utiliser la compensation du point noir
 - Simulation
 - Aplattir l'image pour conserver son aspect

Buttons on the right side of the dialog box include 'OK', 'Annuler', 'Aperçu', and 'Avancé'.

Below the dialog box, there is a small image of an open book. At the bottom of the slide, there is a text box containing the following information:

than does CMYK

- information about the oceanographic features in white boxes are lost in CMYK.



The decision making process

• Summary :

- Use **pixel art** images for **photographic image**.
- Prefer **vector art** for most **everything else**.
- Use layers to organize your graph & photos.
- Use RGB color for Web, photos and Presentation.
- Convert to CMYK at the very last, for printing.

Vector Art

Infinitely Scalable

Formats:
PDF, EPS, SVG, AI

Pixel Art*

Set pixel dimensions

Formats:
PNG, JPEG, TIFF, BMP

CMYK

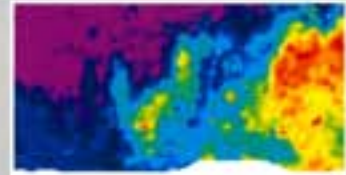


Color printed matter

Almost any figure
in a printed paper

65
WAVLAPTFAYGFKV
WAALAPTLAYGFKV
WVSLITSLSYGGKC
WPTLVTTFSYGVQC
PYLLSHILGYGYH
PLLIGPNLGYGFYQ
YDIITTAFOYGRV
FDIVSVAFSYGNRA

Printed image with
no annotation



300 DPI print; 100 DPI Web

RGB



Web display,
presentations

Diagrams for Web
or presentations



Photo without annotation



300 DPI print; 100 DPI Web

Grayscale

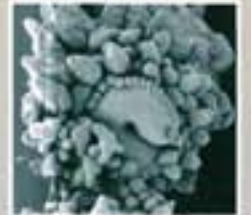


Images without color,
with tonal range

Almost any use,
print or projected



Photo without color
or annotation



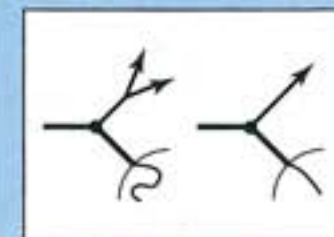
300 DPI print; 100 DPI Web

Black & White



Images without color,
without tonal range

Line drawings



Scanned Text

Rosacea.
pattern o
Praya an

Final resolution:
600 DPI for print
100 DPI for Web