

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*

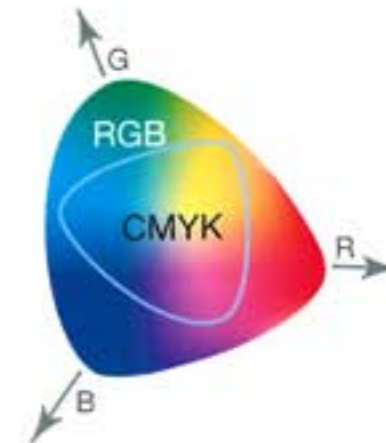
Image resolution and dimensions

Image colors

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

Layers

Why you should avoid powerpoint ?





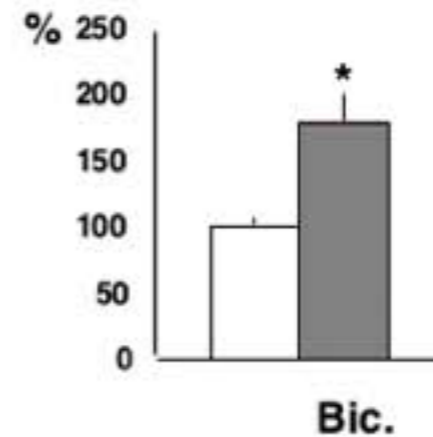
General Image Types



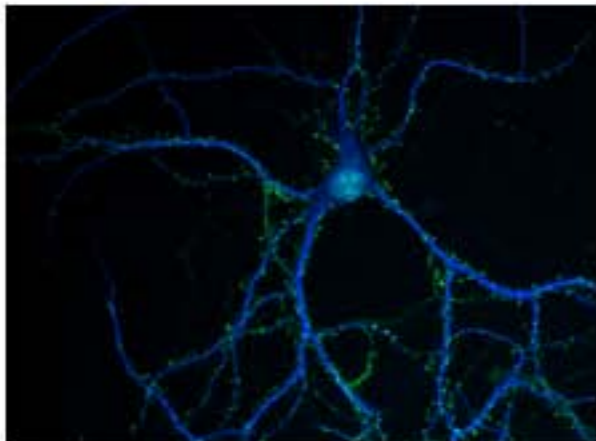
• Vector-based image :



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



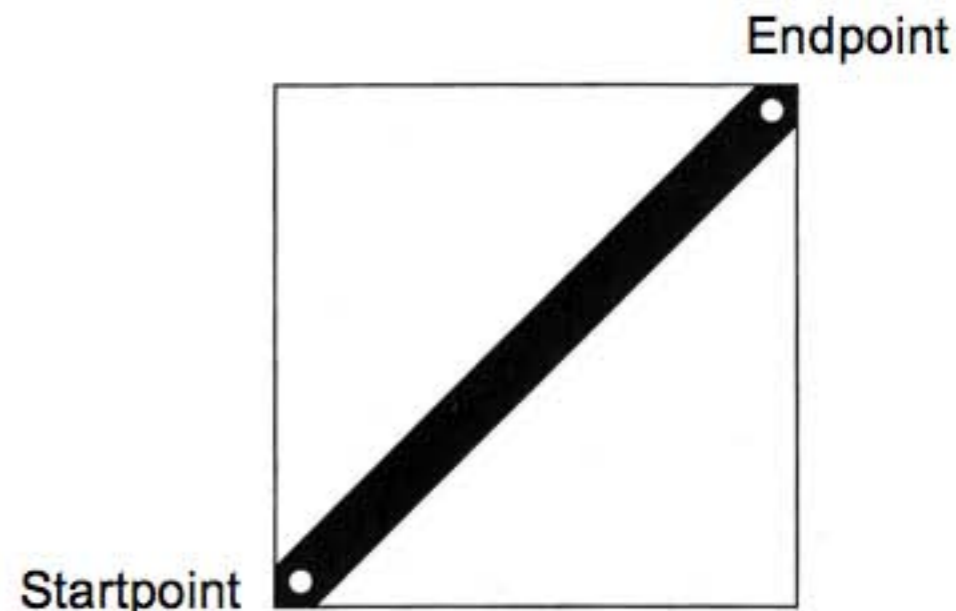
• Vector-based image :



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

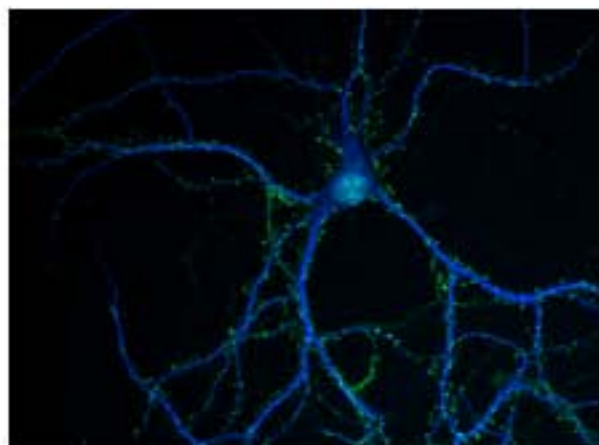
Storing info:

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



A 2 point vector line

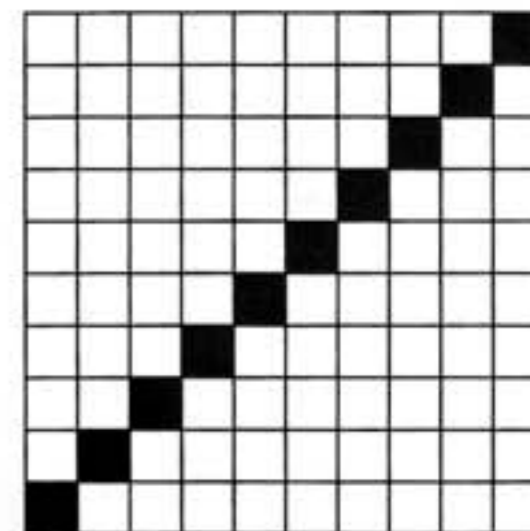
• Pixel-based image = bitmap = raster art :



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 :



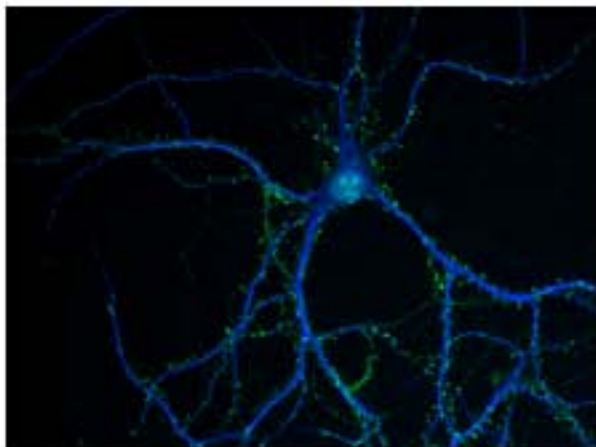
In **vector art** the file format can be :

- 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



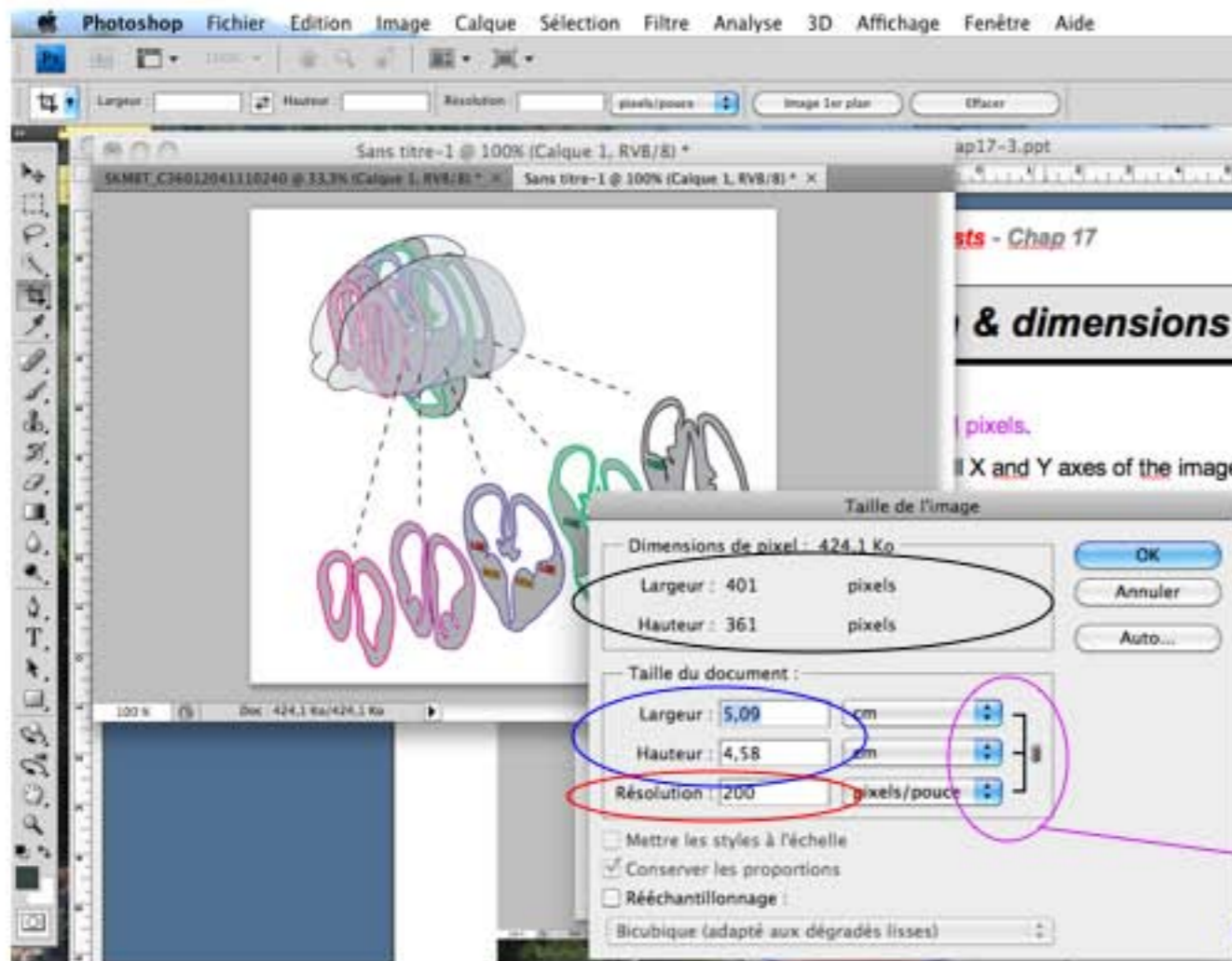
Image resolution & dimensions

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

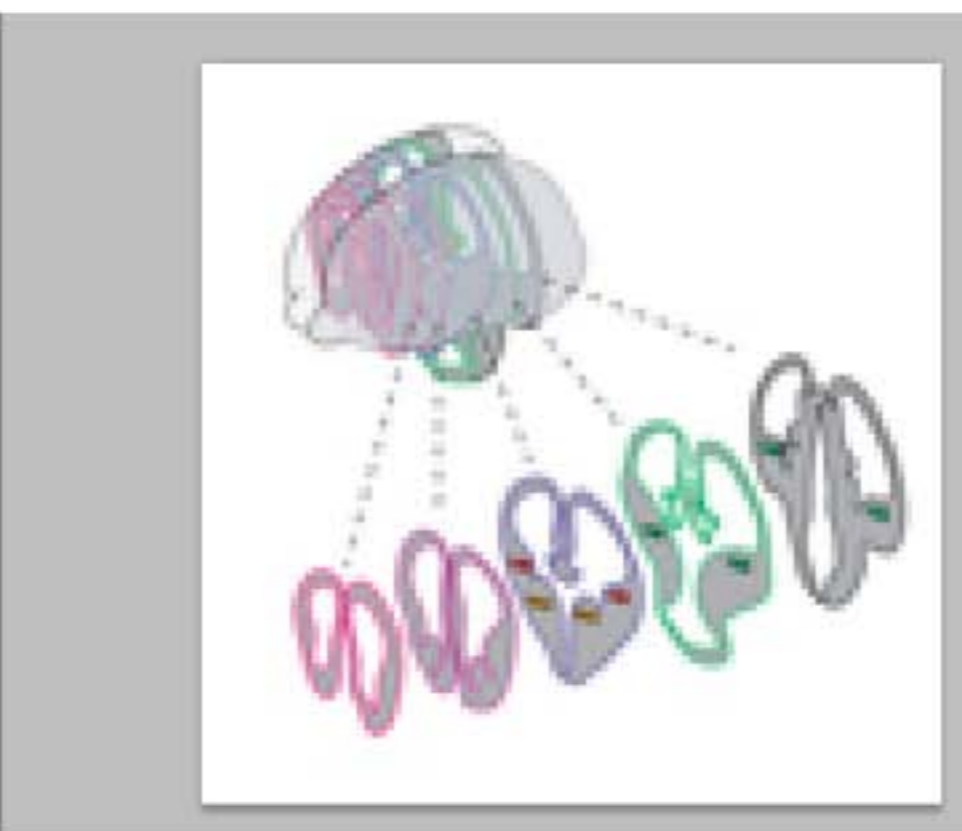
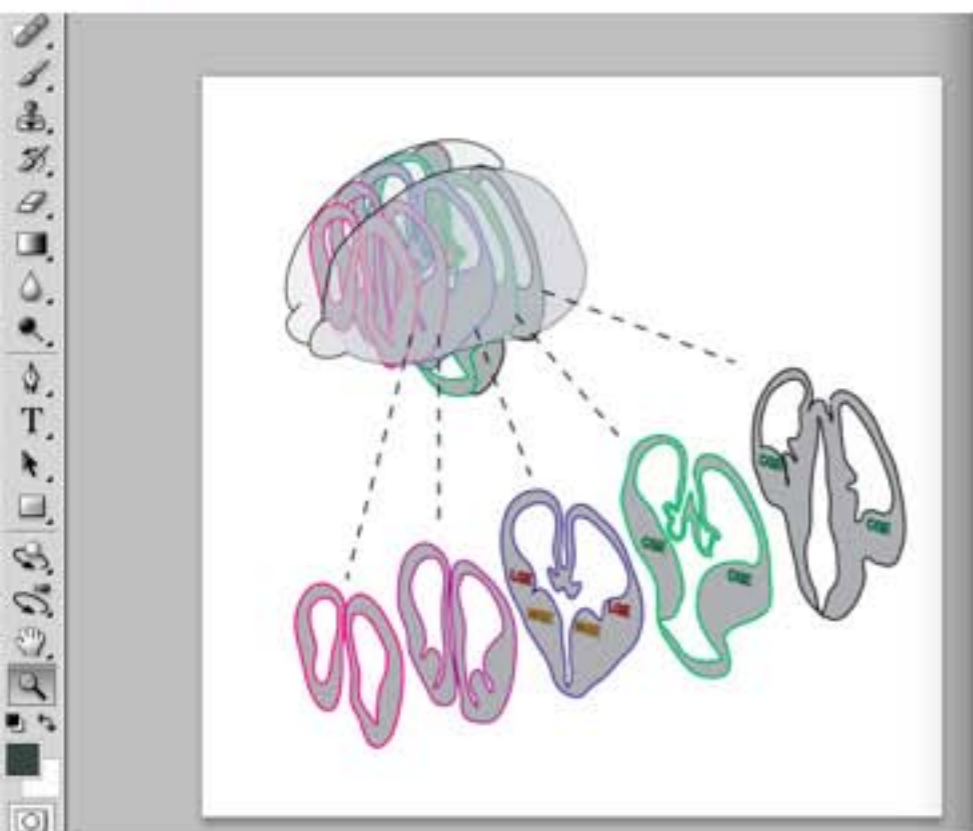
Physical size

Resolution

The 3 parameters are linked.

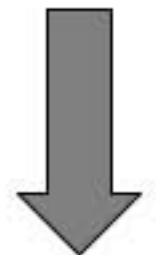


Image resolution & dimensions



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

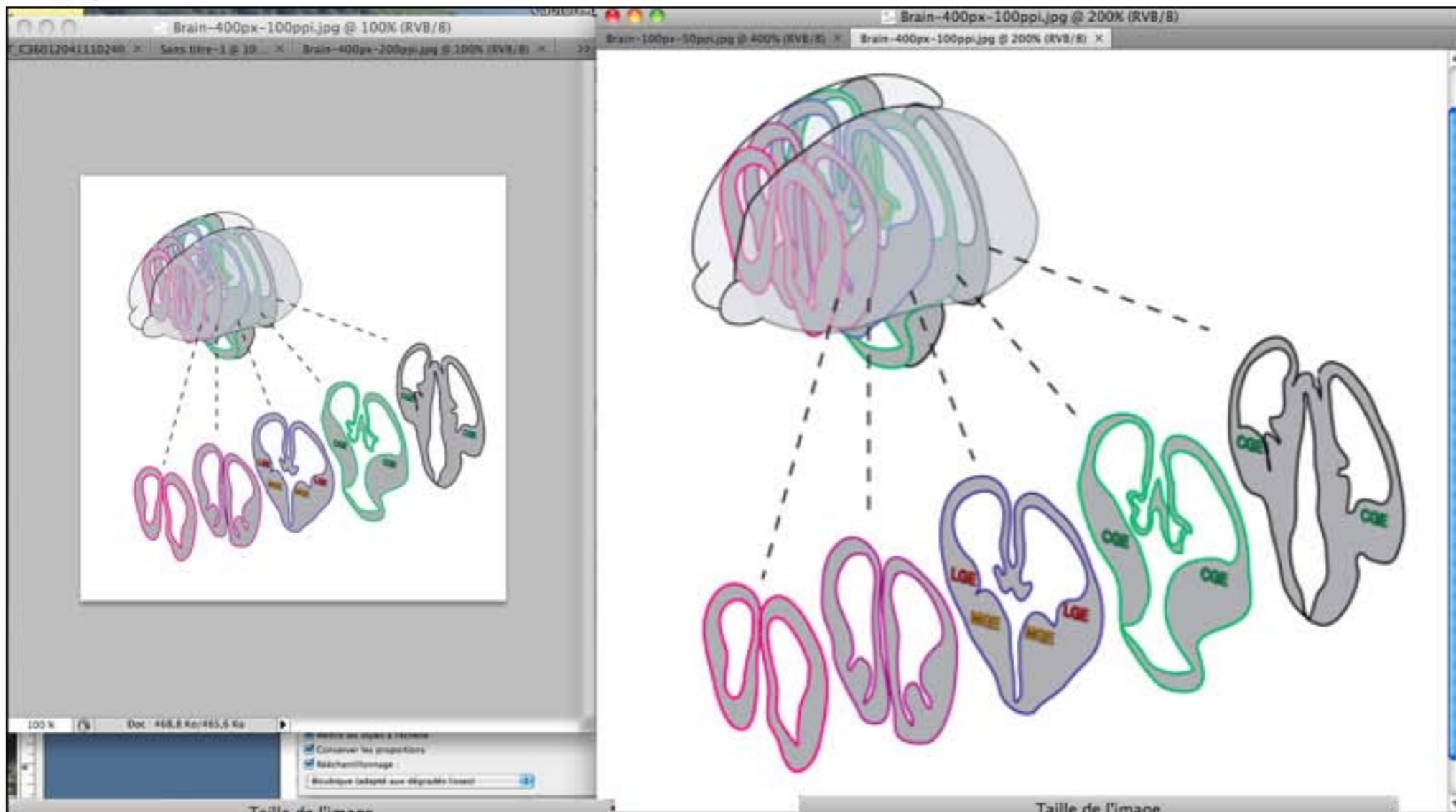
Conserver les proportions

Rééchantillonnage : Bicubique (adapté aux dégradés lisses)

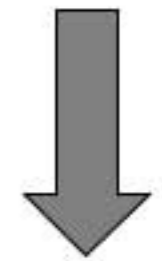
OK, Annuler, Auto...



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)

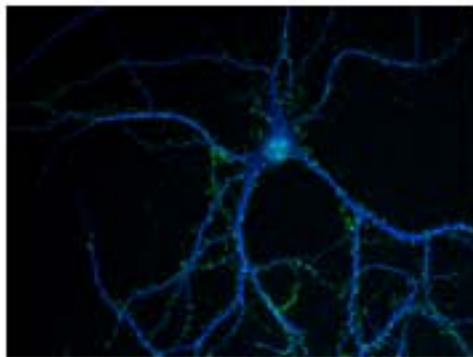
→ *Graphical elements should be created with vector art*



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.

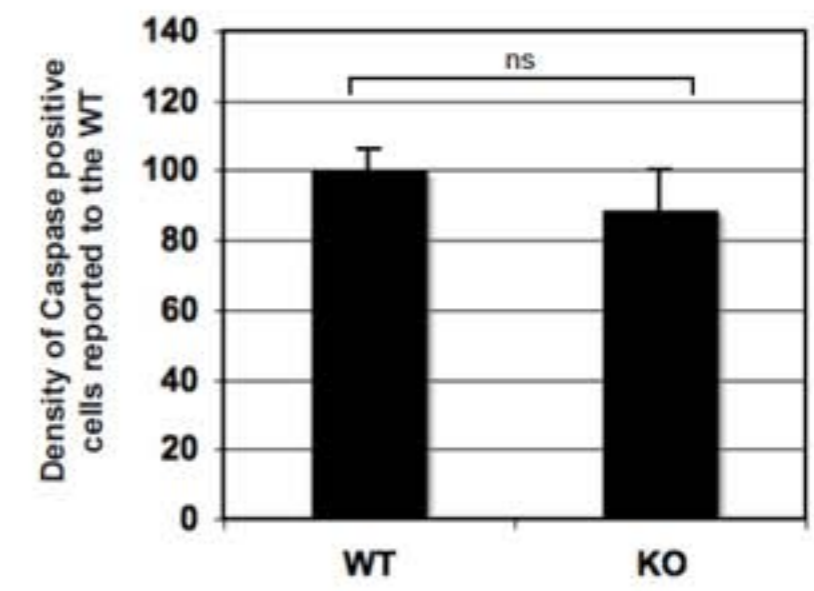
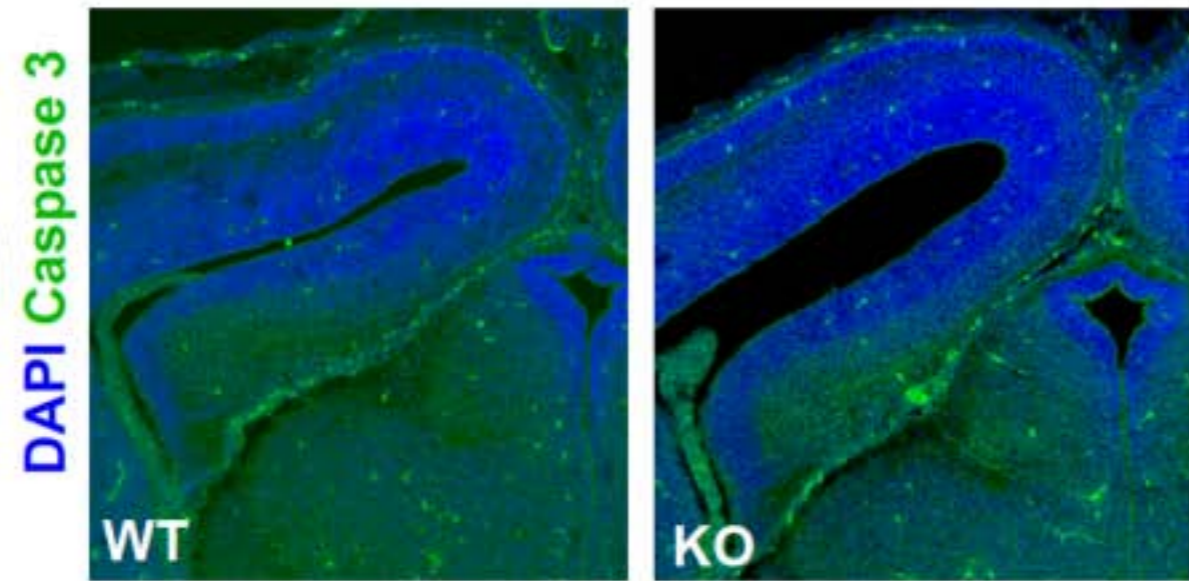
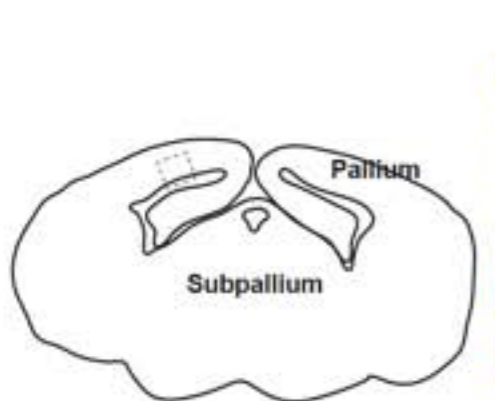
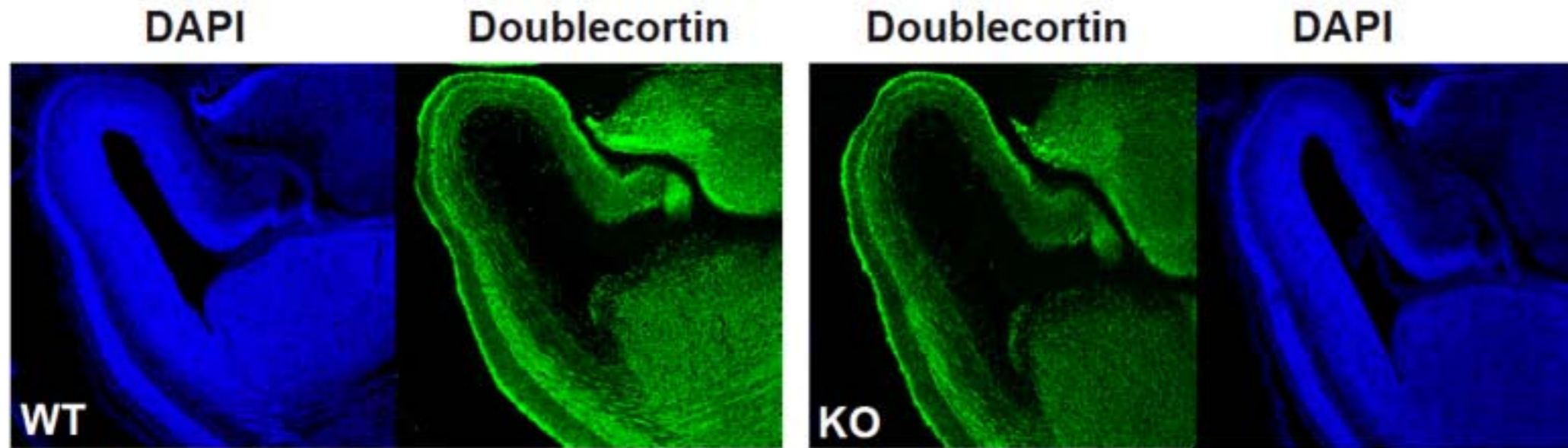


Pixel art format

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 activation and internalization. The process starts with EGF binding to its receptor at 18°C for 1 hour. This is followed by an acid wash at 4°C. Finally, the cells are treated at 37°C for 0, 15, 30, 60, and 120 minutes. Below the diagram are two line graphs showing the 'Kinetics of intracellular EGF' over time at 37°C. The y-axis ranges from 0 to 100. The x-axis shows time points at 0, 20, 40, 60, 80, 100, and 120 minutes. Three data series are shown: Mock siRNA (circles), TI-VAMP siRNA 1 (triangles), and TI-VAMP siRNA 2 (inverted triangles). In both graphs, the Mock siRNA series shows a decrease in intracellular EGF over time, while the TI-VAMP siRNA series remain relatively stable.

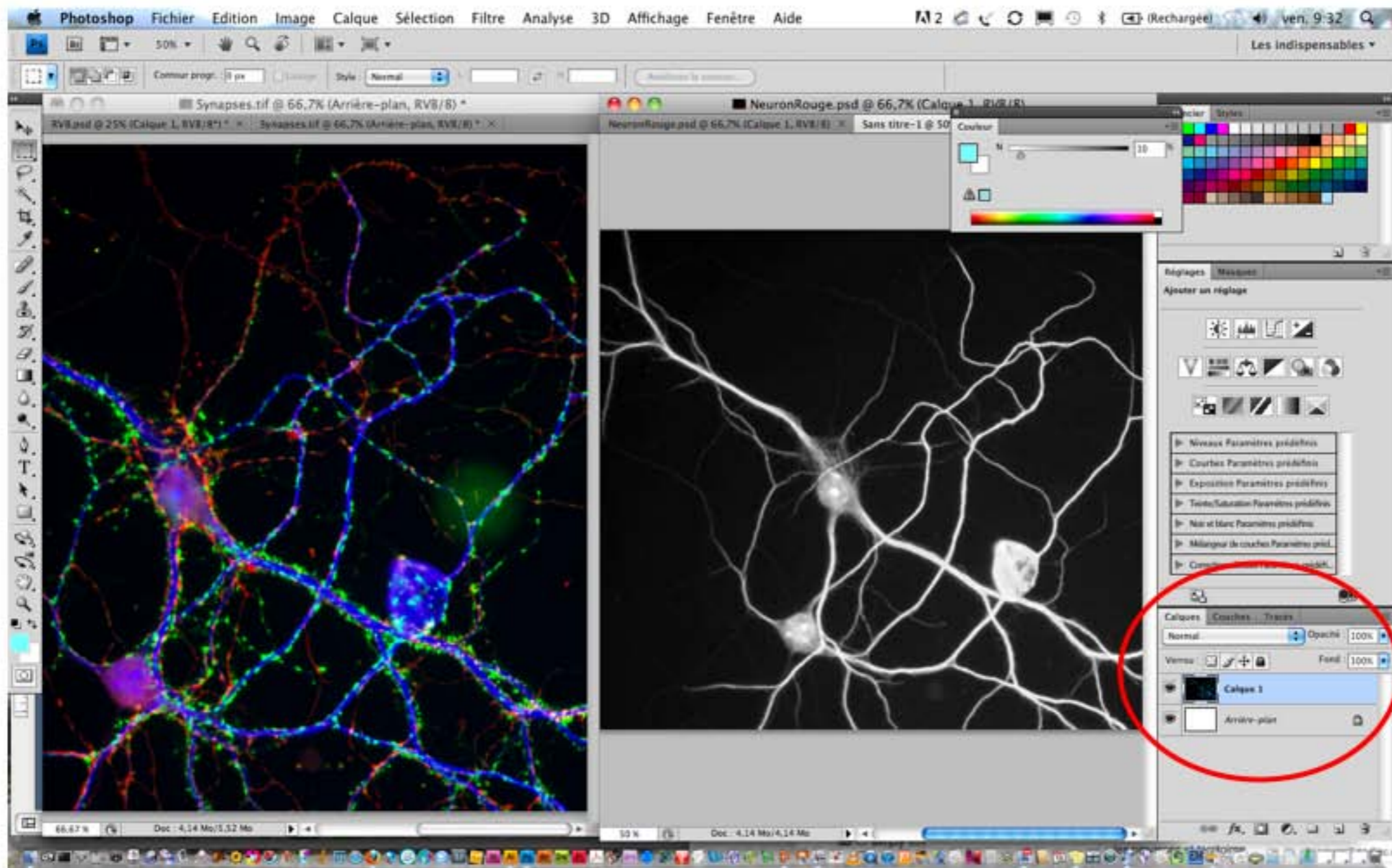
Panel D: Shows a similar diagram but with a 2-hour treatment at 37°C. Below it is a bar graph titled 'EGF-A488' showing 'Intracellular EGF normalized to t=0'. The y-axis ranges from 0 to 100. The x-axis lists siRNA treatments: Mock, TI-VAMP siRNA 1, TI-VAMP siRNA 2, VAMP3, VAMP4, and VAMP8. The bars show that TI-VAMP siRNA 1 and 2 significantly reduce intracellular EGF levels compared to Mock and other siRNAs.

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 ?



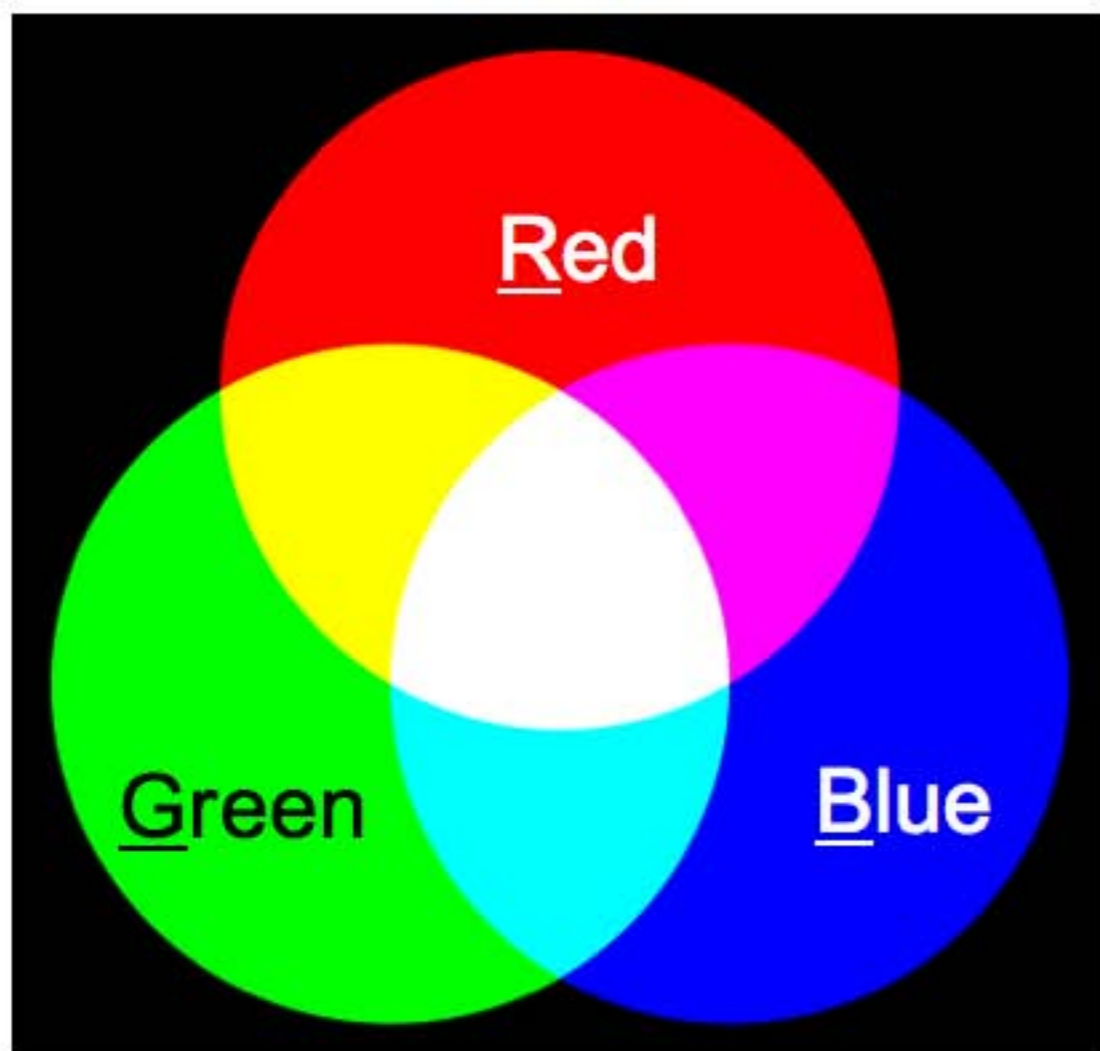


Color models & color space

Additive synthesis

Based on addition of light

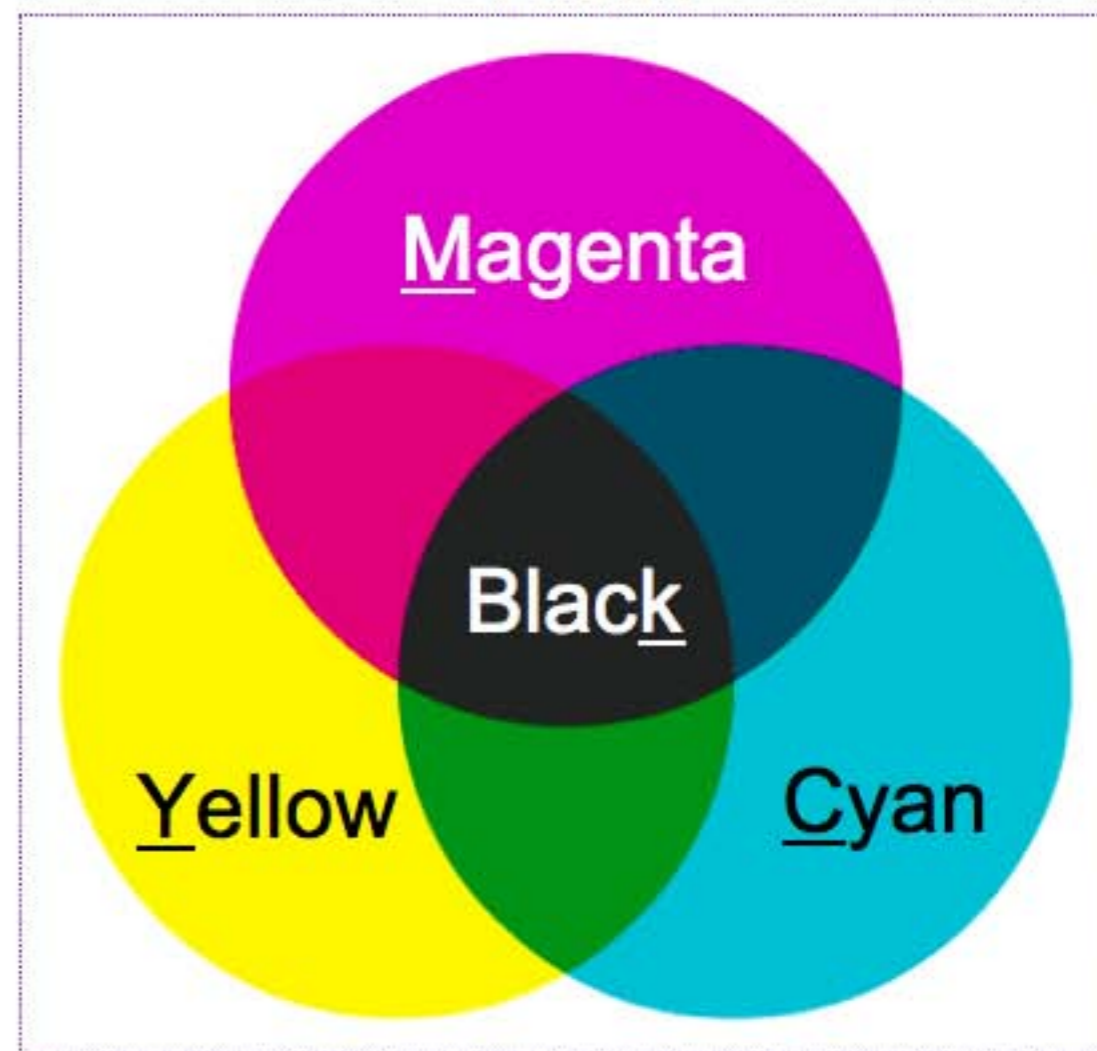
RGB



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

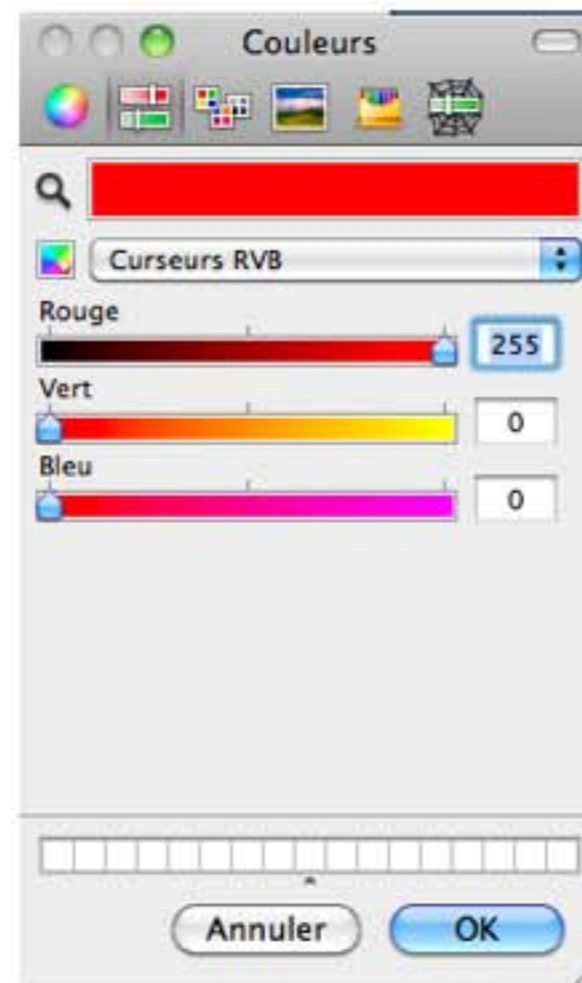
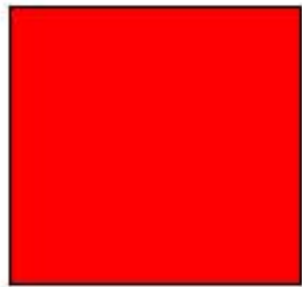
Press - printers

Ink





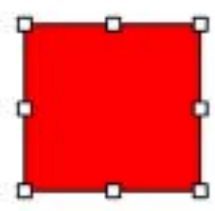
Color models & color space





Practical computing for biologists - Chap 17

Color models & color space



Couleurs

Image: Spectre

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

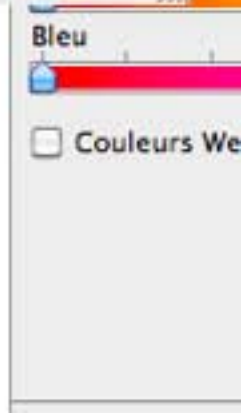
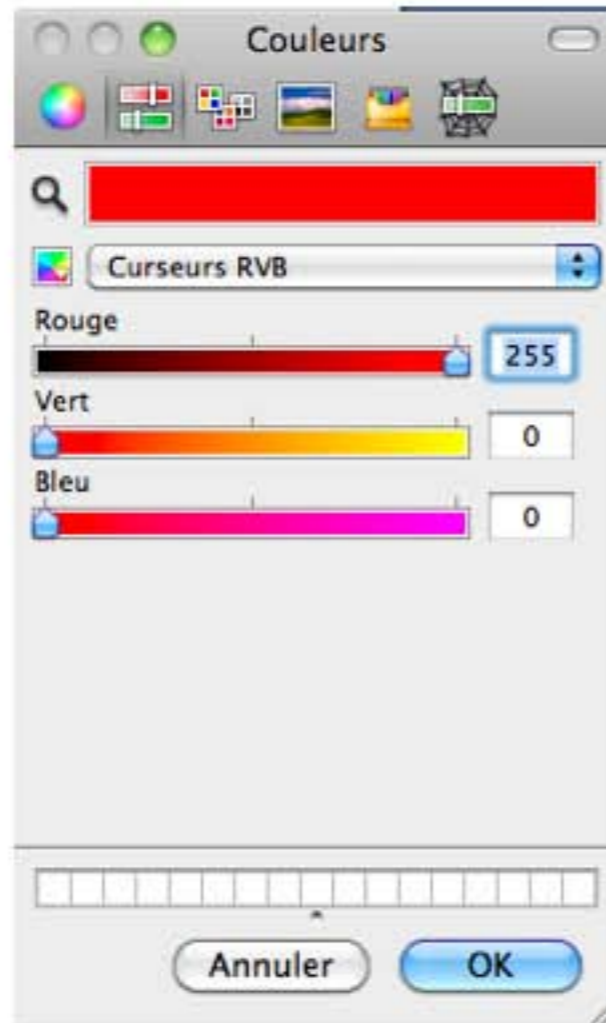
Choisir la couleur du remplissage

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 the RGB color model selected. A context menu is visible over the 'Couleur' panel, listing various color management options. The 'Niveaux de gris' (Grayscale) section is expanded, showing 'RVB' (RGB) as the selected option, along with 'TSL', 'CMJN', and 'Lab'. Other options include 'Curseurs de couleurs Web', '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 a single layer named 'Calque 1' (Layer 1) with a white fill and 100% opacity. 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



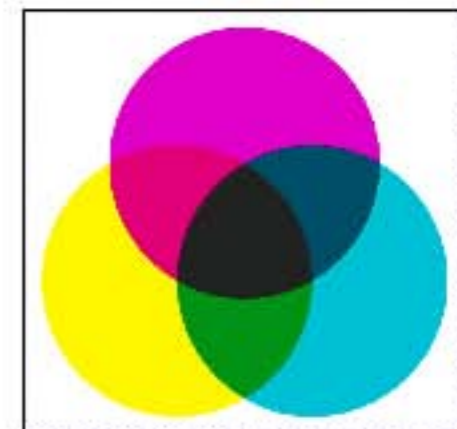
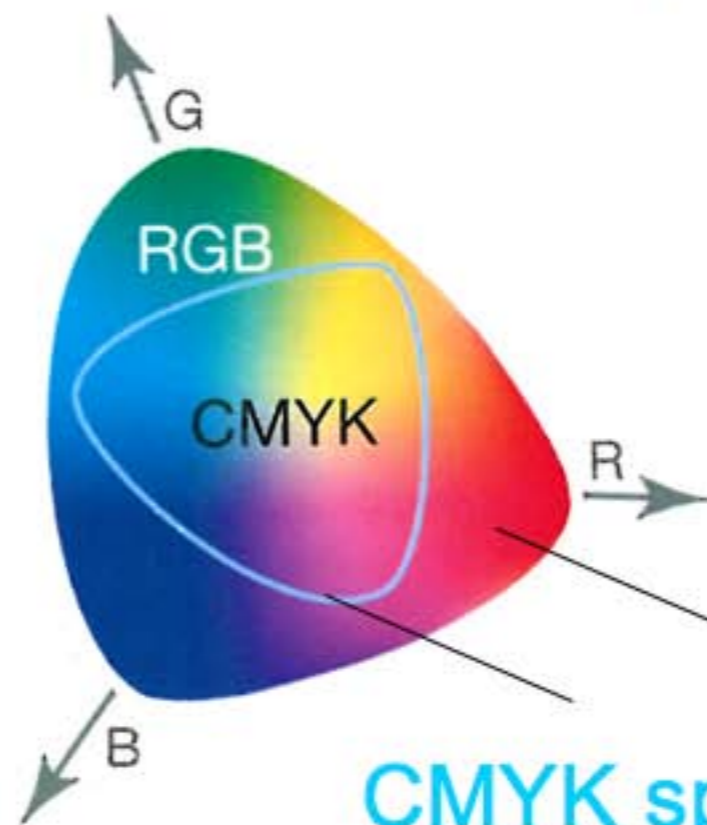
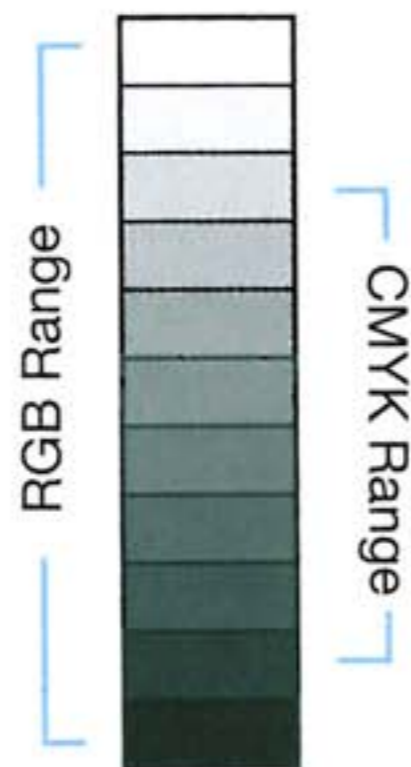
Color models & color space

RGB

screen / projectors

CMYK

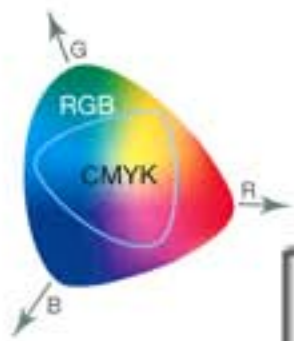
Press - printers



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



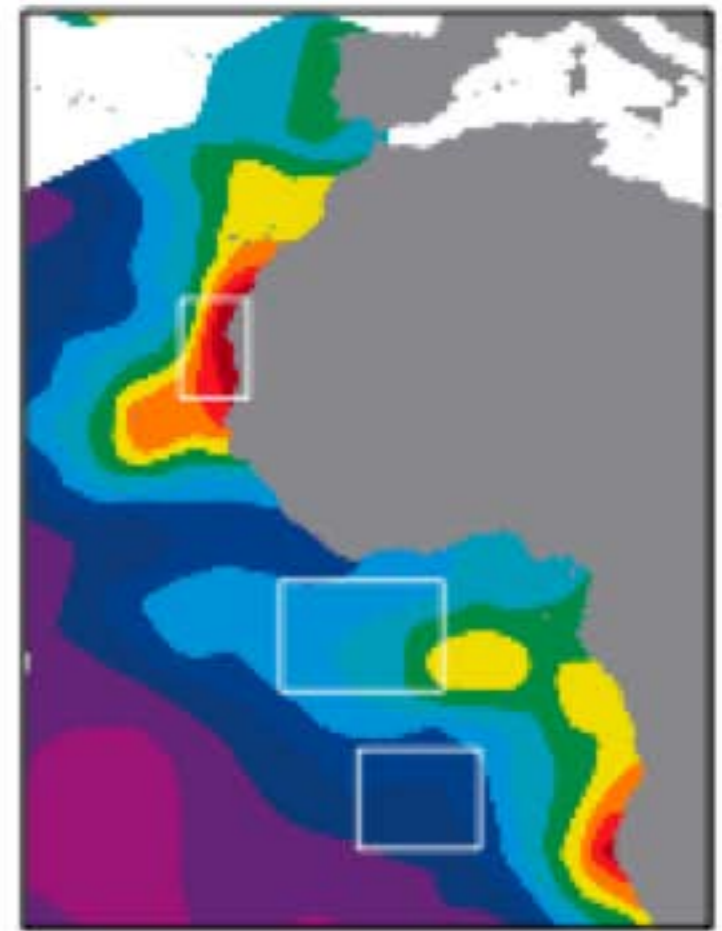
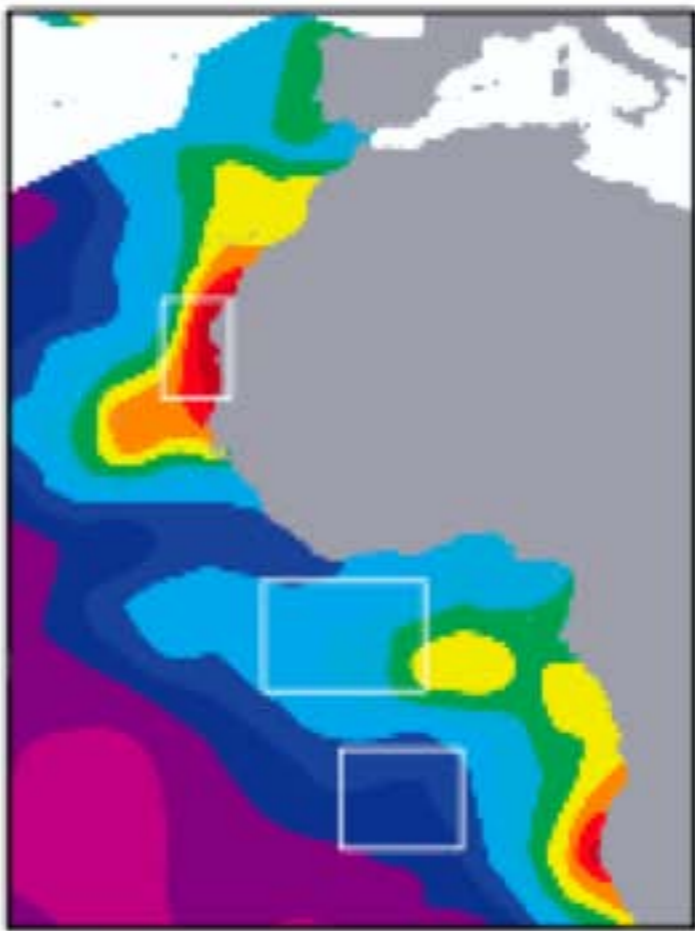
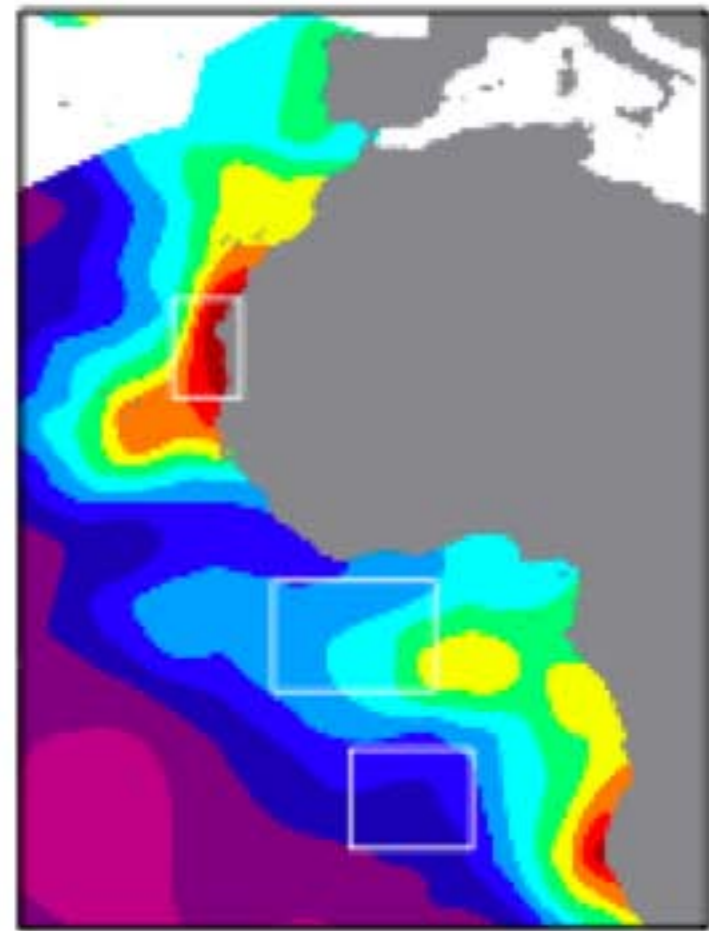
Color models & color space



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... BibliolNSERM Biblio Fournisseurs UJM/PRC BM Seuris Grant Pratic Inserm concours Imagerie

Vischeck **Your brain, just brighter**

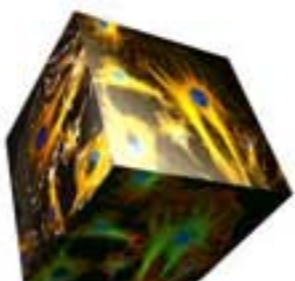
Speed Memory
Attention Problem Solving
Flexibility

Start Training ▶

lumosity

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

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](#)

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.

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



Color choices

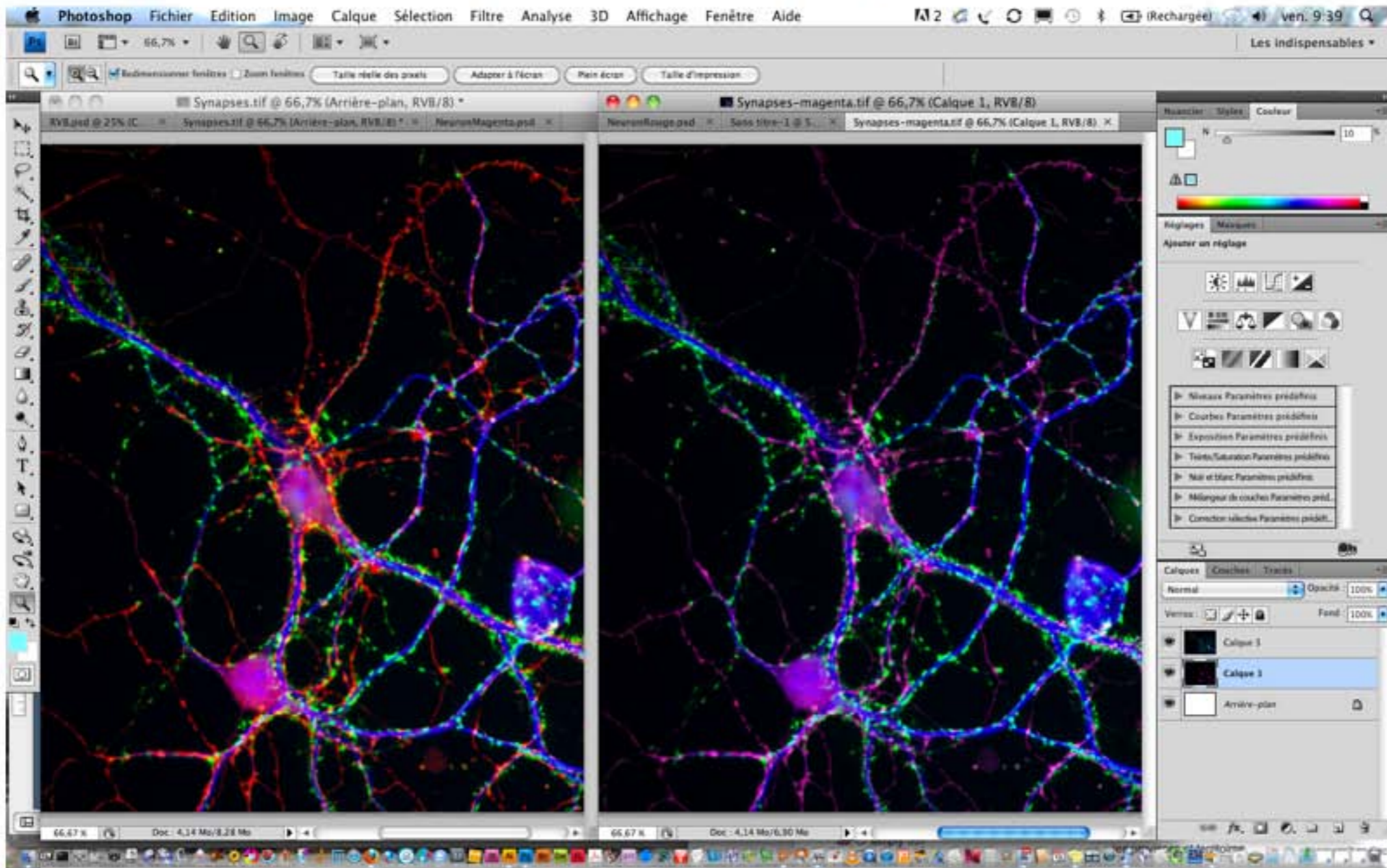
At least **7% of males** have some degree of **color blindness**, which affects the ability to tell red and green apart. For this reason, you should avoid using red, and replace it by magenta.

A screenshot of a web browser displaying the Vischeck website. The browser's address bar 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 the slogan "Your brain, just brighter". Below the header, there is a section titled "Try Vischeck on Your Image Files" with the heading "Your Results:". This section displays three side-by-side images of a biological network (neurons or cells) on a black background. The first image is labeled "Original Image" and shows a complex network of lines in red, green, and blue. The second image is labeled "Deuteranope Simulation" and shows the same network with the red and green colors shifted towards blue and yellow. The third image is labeled "Protanope Simulation" and shows the network with the red and green colors shifted towards purple and yellow. 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)" which is selected, and "Protanope (another form of red/green color deficit)". The left sidebar of the website contains navigation links such as Home, Vischeck, Run Images, Run Webpages, Daltonize, Examples, Downloads, Info & Links, FAQ, and About Us. There is also a search bar and a "Google Search" button.



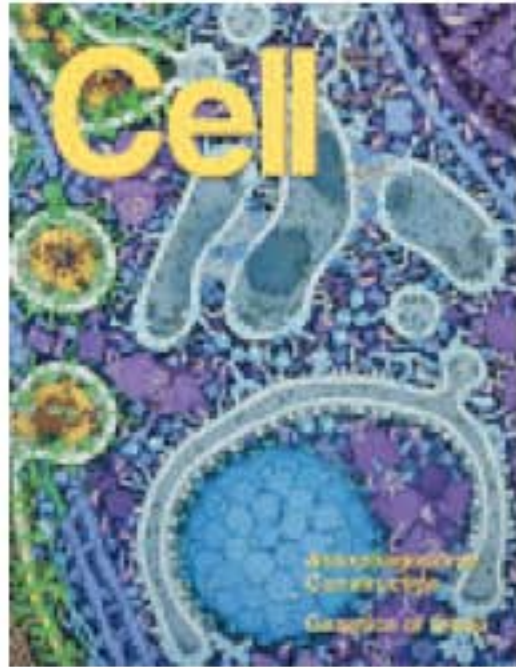
Color choices

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

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 Tracés

Normal Opacité 100%

Verrou Opacité 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

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)

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

The screenshot shows the Adobe Photoshop interface with the 'Edition' menu open. The 'Attribuer un profil' dialog box is the central focus, with the following options:

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

The background image features a color calibration chart and a text box containing the text 'MYK to publish'. Below the text box, there is a note: 'than does CMYK' and 'graphic features in white boxes are lost in CMYK.'

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...
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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

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Mélangeur de couches Paramètres prédéfinis
Correction sélective Paramètres prédéfinis

Calques Couches Traces

Normal Opacité 100%

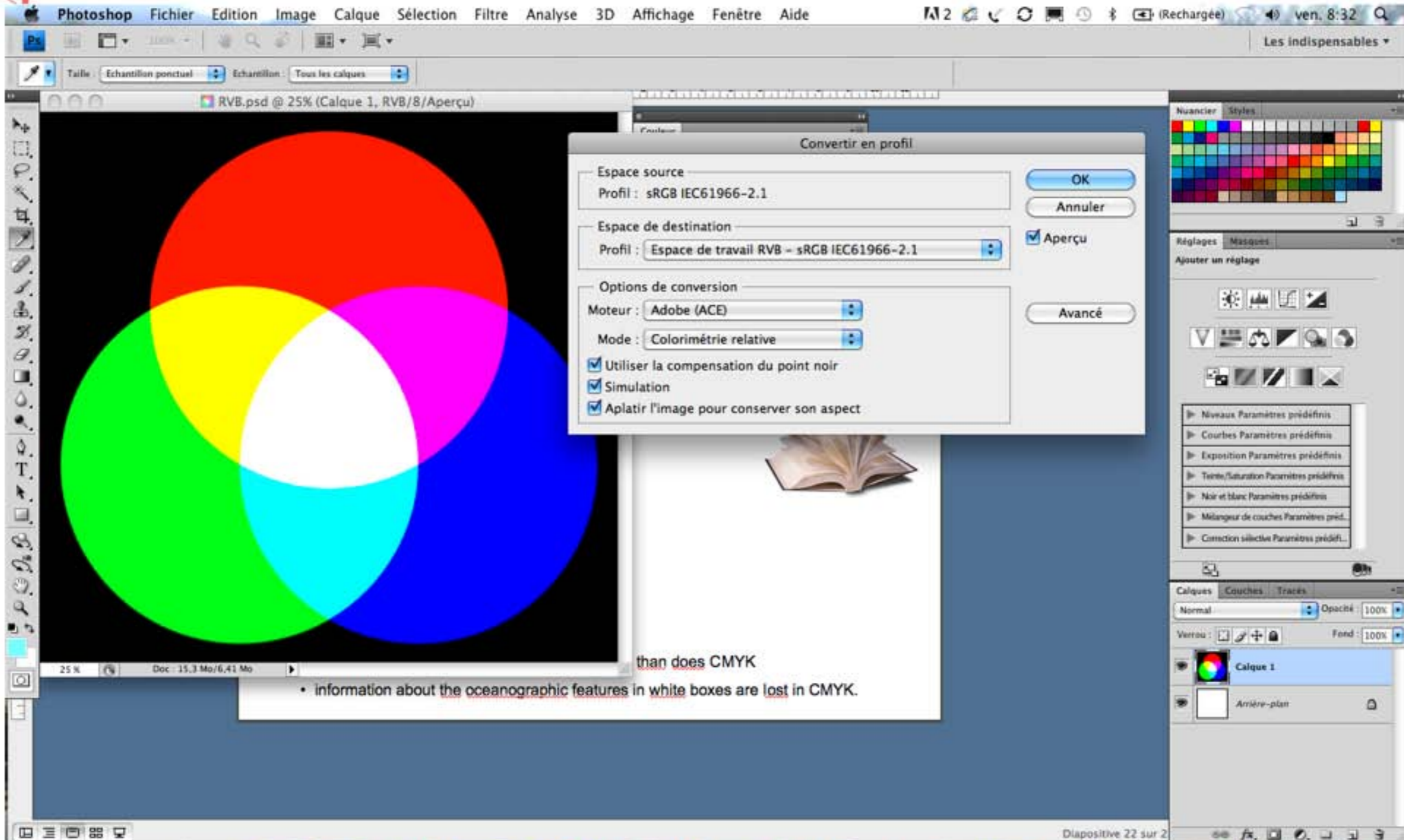
Verrou Fond 100%

Calque 1

Arrière-plan

Diapositive 22 sur 2

Converting *RGB* to *CMYK* to publish



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 of the Photoshop window shows a color calibration chart with four overlapping circles (red, yellow, cyan, magenta) and a white center. The Photoshop interface includes the menu bar (Fichier, Edition, Image, Calque, Sélection, Filtre, Analyse, 3D, Affichage, Fenêtre, Aide), the 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

than does CMYK

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

Diapositive 22 sur 2



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
YDIITTAFOYGFYQ
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