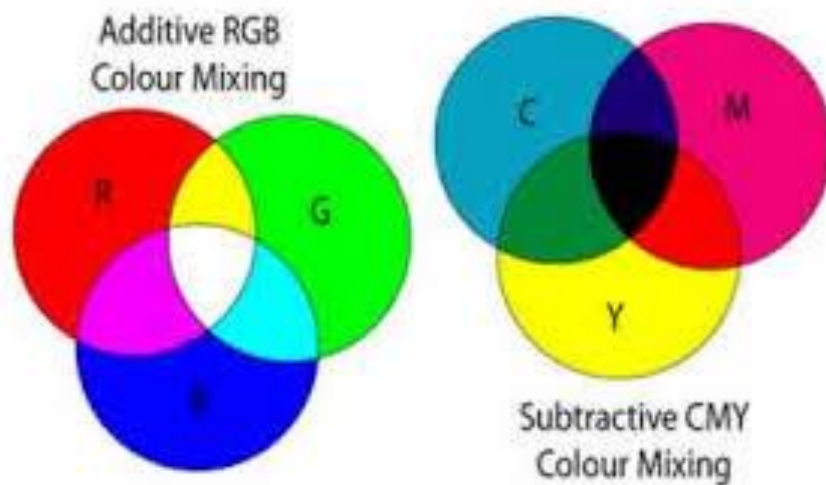


COLOURS AND COLOUR MANAGEMENT

RGB and CMYK

<http://www.printingforless.com/2/processprinting.html>

COLOUR MIXING



Additive Colour Mixing RGB	Subtractive Colour Mixing CMY
Red + Green = Yellow	Cyan + Magenta = Blue
Blue + Green = Cyan	Magenta + Yellow = Red
Red + Blue = Magenta	Cyan + Yellow = Green
Red + Green + Blue = White	Cyan + Magenta + Yellow = black (Key)

Used in: monitors, projectors, scanners

Used in: printers

COLOUR THEORY:

Whatever is used in the way of technical aids or colour classification systems must be aligned with

1. the colour perception of **the eye of the human observer**
2. and in the range of **spectrum of electromagnetic waves** visible to the human eye.

Both additive and subtractive colour mixing processes occur in modern reproduction theory.

In additive colour mixing light is emitted by the source of its own.

In subtractive colour mixing light is partially absorbed and partially reflected by the printing plate (podložka).

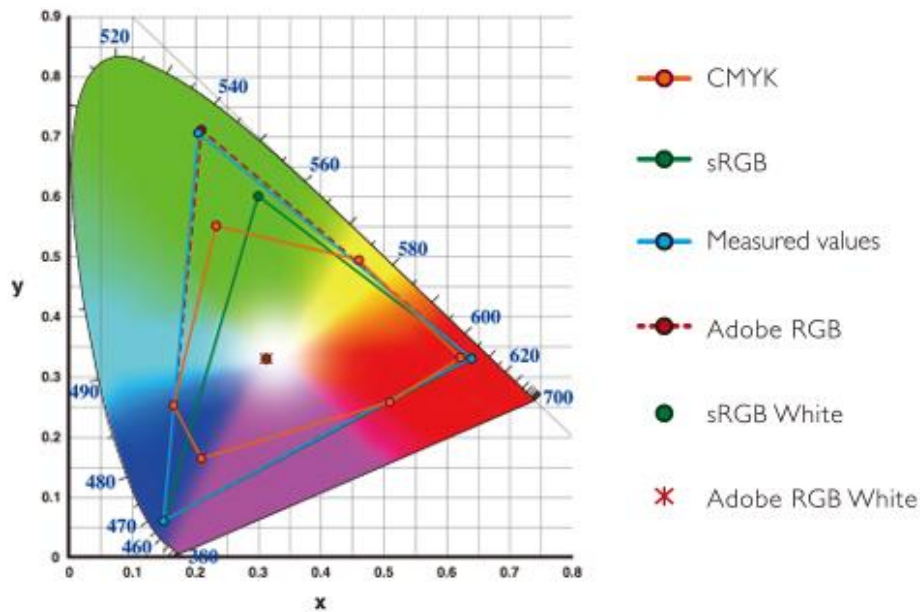
A specification of light sources so-called *standard illuminants* (natural daylight D65) were introduced by the CIE.

In 1931 the CIE specified the colour matching functions of R, G, and B in accordance with the empirical properties of the observer.

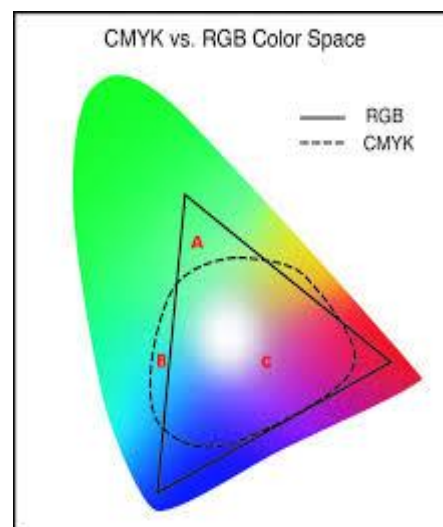
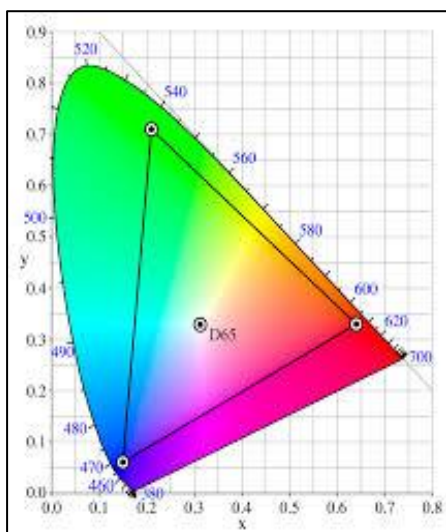
X = an imaginary red

Y = an imaginary green

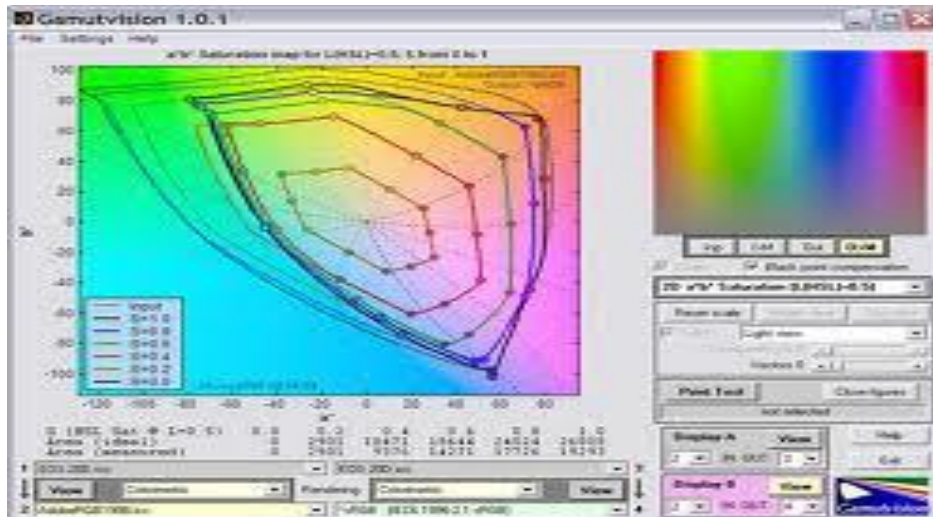
Z = an imaginary blue colour stimulus specification.



Colour gamut in the CIELAB system for different reproduction processes



Chromaticity diagram (CIE colour space, CIE colour triangle)



Colour gamuts in the CIELAB system for different reproduction processes

How 4 Colour Process Printing (CMYK) Works



Four colour process printing is a system where a colour image is separated into 4 different color values (called a color separation) **by the use of filters and screens**. This used to be done

1. **with photographic film on a graphic arts camera,**
2. **with software.**

The result is a colour separation of 4 images that when **transferred to printing plates and sequentially printed on a printing press with the colored inks cyan (blue), magenta (red), yellow and black (the key, k in cmyk)**, reproduces the original colour image.

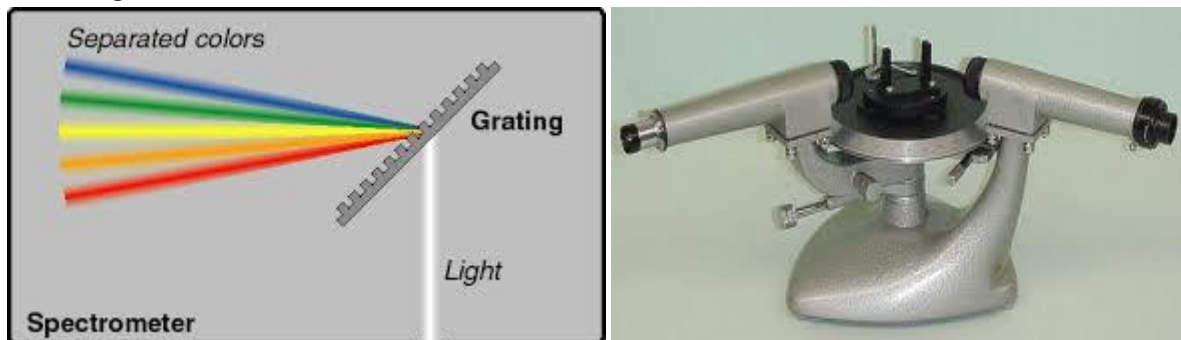
Most of **the entire spectrum or gamut of colours** are reproduced with just the four **process ink colours**. The four colour printing process is universally used in the graphic arts and commercial printing industry for the reproduction of colour images and text.

COLOUR MANAGEMENT SYSTEM

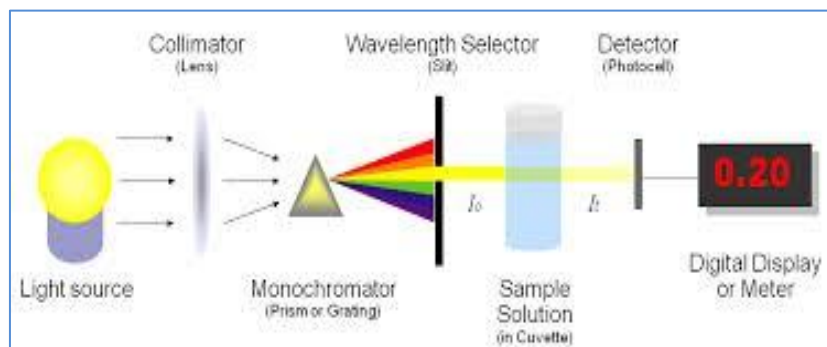
A special form of colour classification systems may be mentioned briefly at this point: **COLOUR SAMPLE CATALOGS** such as **Pantone**, **HKS**, or **RAL**. They do not serve as a systematic description of all colours. The Pantone reference value cannot be matched in the actual CMYK colour space of printing system. The approximating solution is usually determined empirically by colour mixture trials or by means of colour management system.

The Colour management system works with

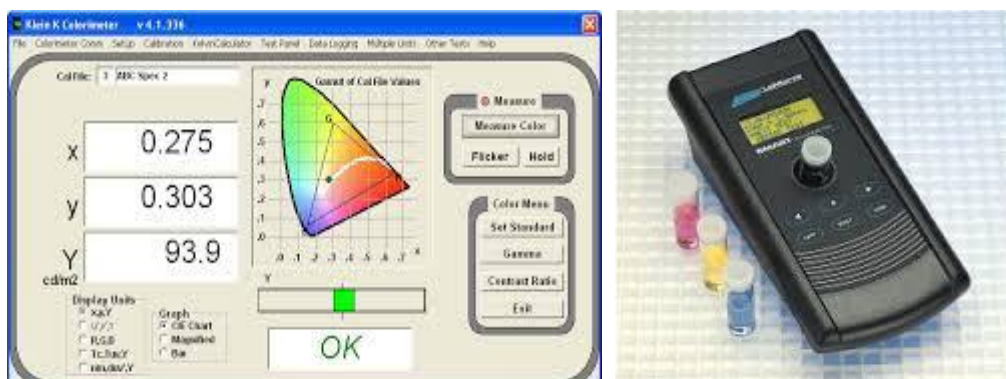
- spectral measuring instruments (*spectrophotometers*) which is processed by means of digital filtration



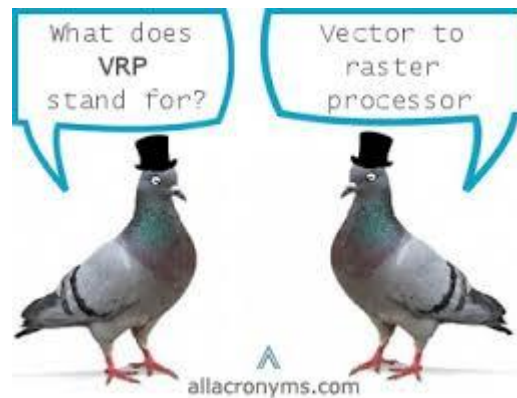
- and tristimulus colour measuring instruments (*colorimeters*). Filtration is done using optical filters.



When applying colour management profile quality loss between input (for monitor) and output (onto plate or proofer) must be expected.



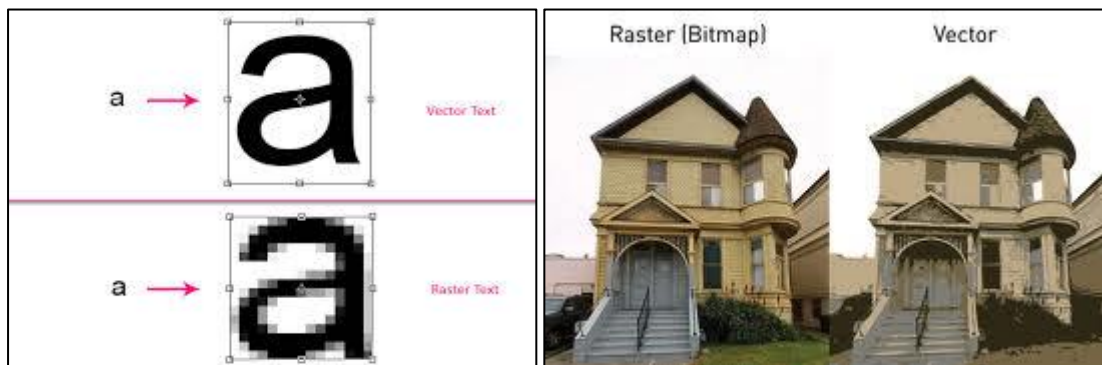
Editing and processing of images on computer



Modern digital input processes

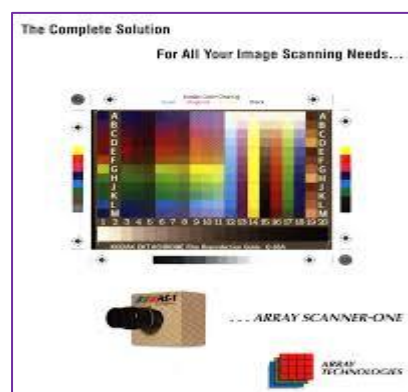
such as **scanners, digital cameras, or photo CDs** allow flexible editing and processing of images on computer.

Digital images consist of an arrangement of small squares known as picture elements or **pixels**. When scanning in, the input devices reduce the visible color spectrum to the **RGB** colour system, for which one colour set is allotted to each pixel.



Resolution: Image resolution: 72 dpi/ppi (web), 300 dpi/ppi (print).

- Scanners



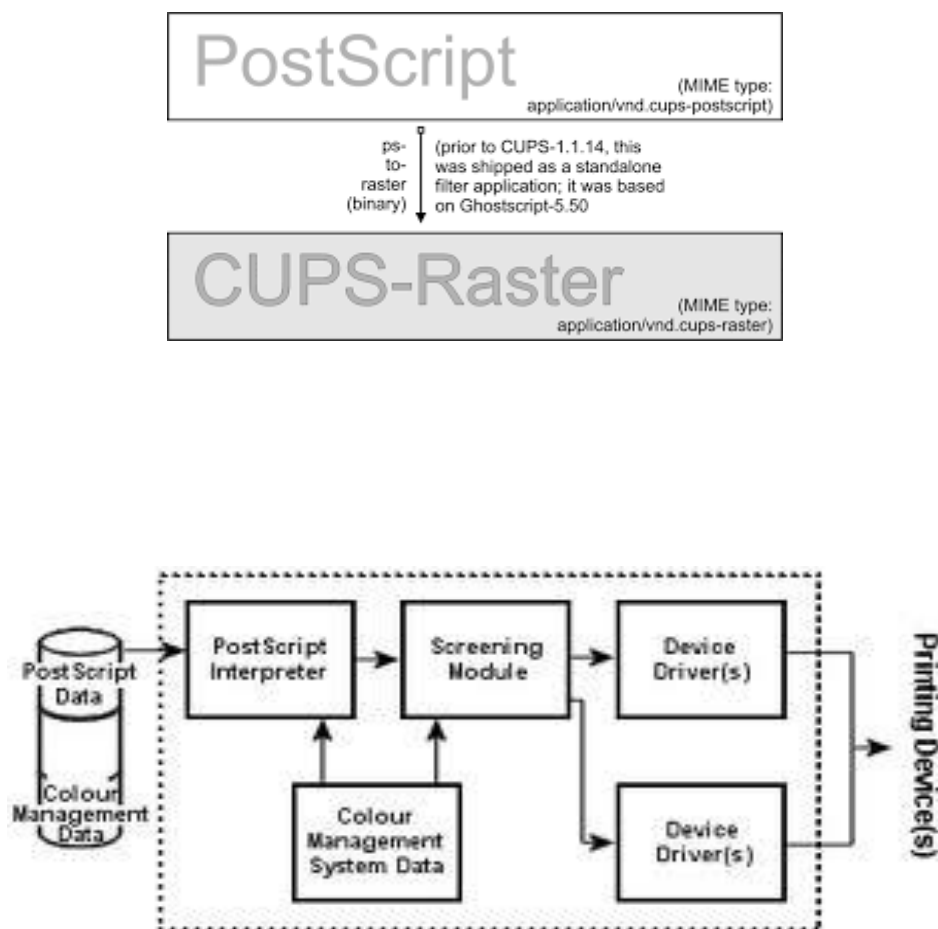
The resolution of scanners is usually quoted in pixels per inch (ppi) or dots per inch (dpi).

RIP = a *Raster Image Processor* comprises all function modules that are required for the **translation of a complex page description into a device-specific data format- bitmap data.**

In most RIP electronic printing system a ‘controller’ follows if bitmap data is transferred correctly to the actual printing unit. (PostScript, *Portable Document Format - PDF*, *Joint Photographic Expert Group - JPEG*, other image formats are **TIF**, **EPS**).

Rendering (bitmaps)

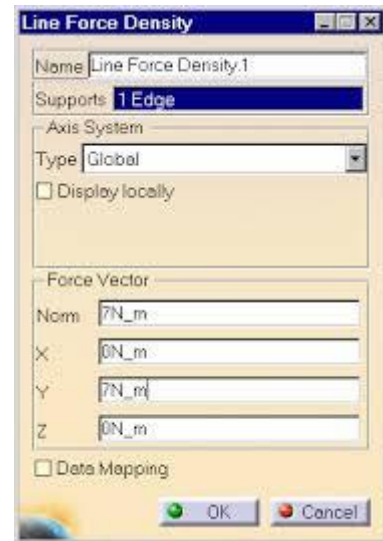
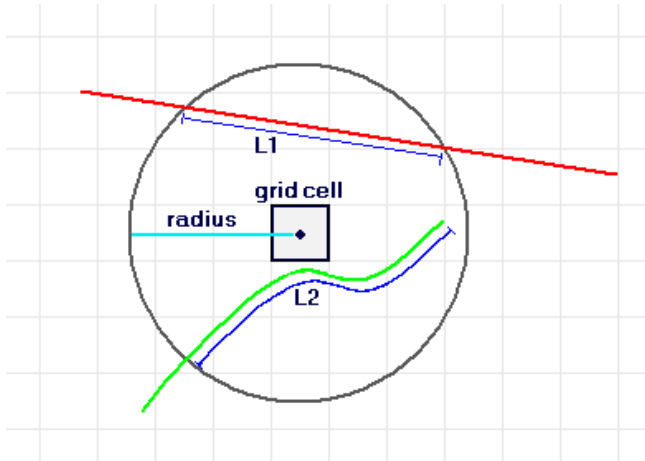
Modern term that means that **the reproduction of colours may be chosen specifically depending on purpose of the reproduction**



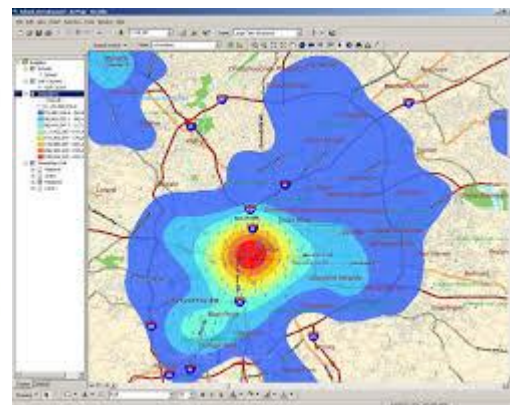
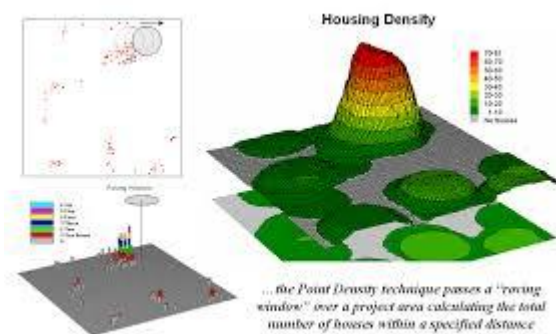
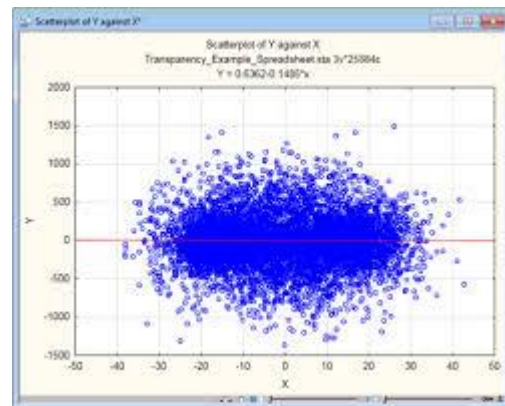
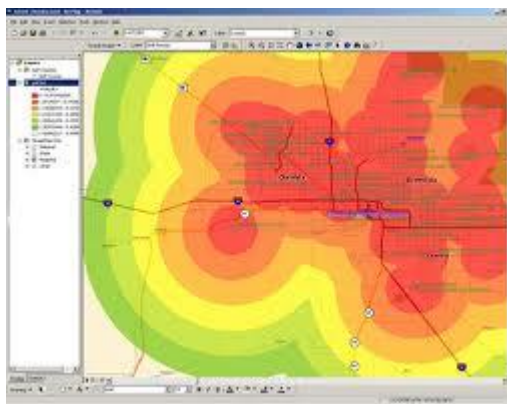
Scheme: from the input to the output/printing device

Three density tools:

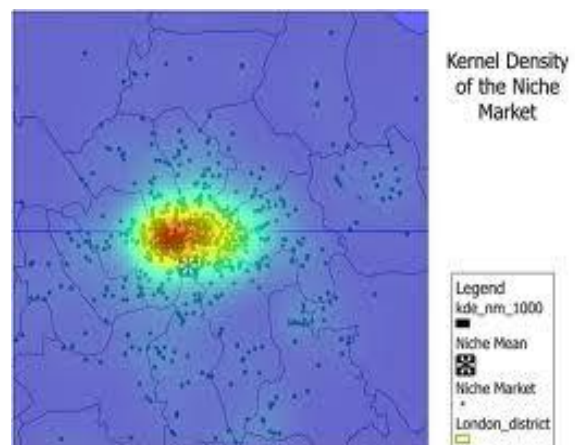
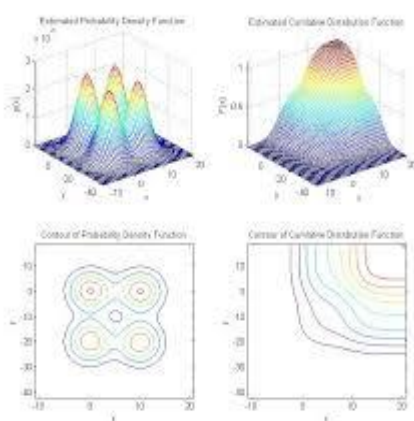
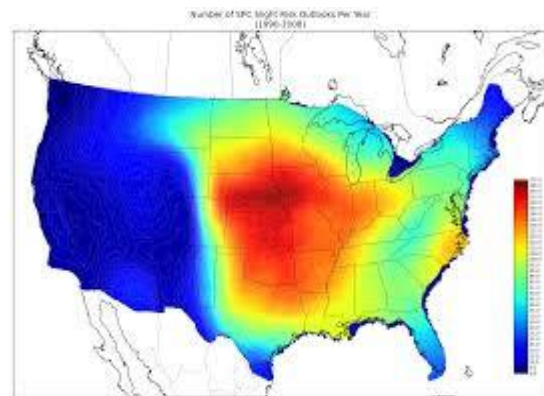
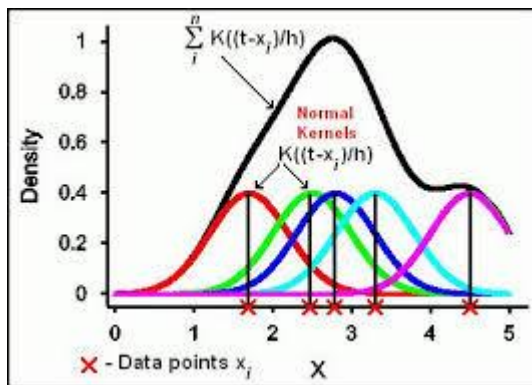
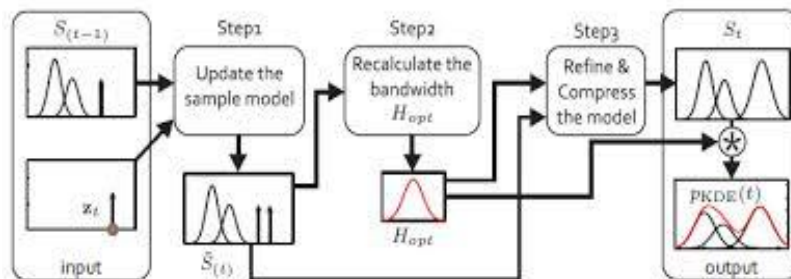
- **Line Density** calculates a magnitude per unit area from polyline features that fall within a radius around each cell (unit **lpi** = lines per inch or **l/cm** = lines per centimetre)



- **Point Density** calculates a magnitude per unit area from point features that fall within a neighbourhood around each cell



- **Kernel Density** calculates a magnitude per unit area from point or polyline features using a kernel function to fit a smoothly tapered surface to each point or polyline



All density tools produce new raster datasets.

Screening - in order to print, two screening methods are used:

- **AMPLITUDE MODULATION (AM)** screening: dots are placed in a fixed grid and dot size varies depending on density
- **FREQUENCY MODULATION (FM)** screening – dot size remains constant and dots are placed in random order to create darker or lighter areas and are controlled by mathematical algorithms

FM-Raster and AM-Raster

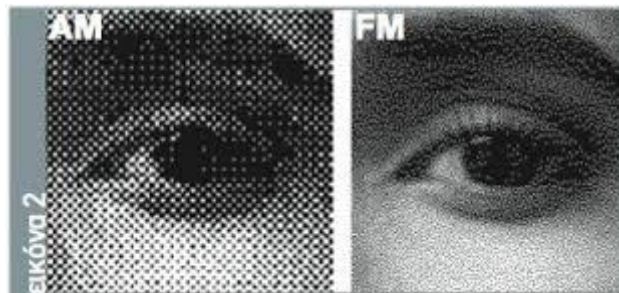
FM-Raster



Beispiel eines Verlaufs im FM-Raster



Zum Vergleich ein Verlauf im konventionellen AM-Raster



Shapes of printing points

Raster AM has different shapes of printing points such as:
round, round-square, elliptic, megadot.

Raster FM shapes of printing points are
diamond, satin fine, prinect stochastic fine, prinect stochastic medium.

TASK:

Students prepare short presentations about data files: JPEG, PostScript, PDF and will discuss on the topical themes.

Classic Colour Schemes

It is the fact that colours also are the source of decisive strength in printing. The most important things before printing are mixing of the desired and correct colours. The schemes enables to realize how to combine colours – single, monochromatic, warm, cool. There is the whole spectrum of colours running from the brightest and most garish to the coolest and most subdued.

Monochromatic colour scheme



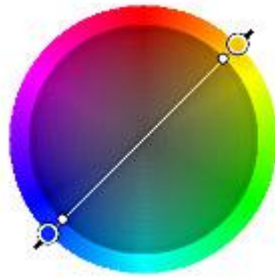
- uses variations in **lightness and saturation of a single colour**. This scheme looks clean and elegant. Monochromatic colours go well together, producing a soothing effect.

Analogous colour scheme



- One colour is used as a dominant colour while others are used to enrich the scheme. The analogous scheme is **similar to the monochromatic one, but offers more nuances**. **Avoid combining warm and cool colours** in this scheme.

Complementary colour scheme



- is made of two colours that are opposite each other on the colour wheel. This scheme looks best when you put a warm colour against a cool colour.

Triadic/triple colour scheme



- uses three colours equally spaced around the colour wheel. This scheme is popular among artists because it offers strong visual contrast while retaining balance, and colour richness.

Business, Sales and the World Wide Web Are In Colour

Colours are also means of communication. They are fascinating, evocative and more successful in terms of psychology.

Colour psychology

By using color psychology, you can send:

- a positive or negative message
- encourage sales
- calm a crowd

The latest colour psychology is focused on marketing, particularly:

- in logo design
- web site design
- the cover of a book
- the package of a product.
-

NOTE:

This information will help you decided **what colors to use in your marketing projects.**

Also remember for the World Wide Web, that **different cultures have differing views on the meaning of color.**

Black

Black is the color of authority and power, stability and strength. It is also the color associated with intelligence (doctorate in black robe). Black clothes make people appear thinner. In the western hemisphere black is associated with grieving.

White

For most of the world this is the colour associated with purity (wedding dresses); cleanliness (doctors in white coats) and the safety of bright light.

White is also associated with creativity (white boards, blank slates). It is a compression of all the colors in the color spectrum.

Gray

Gray is most associated with the practical things in life. Some shades of gray are associated with old age, death, taxes, depression or a lost sense of direction but gray is often associated with giving a helping hand, strong character

Red

Red is the colour of energy. It's associated with movement and excitement.

Red is the symbol of life and, for this reason, it's the colour worn by brides in China. Red is used at holidays that are about love and giving (red roses, Valentines hearts, Christmas, etc.)

Blue

Seeing the colour blue actually causes the body to produce chemicals that are calming; but that isn't true of all shades of blue. Over the ages blue has become associated with wisdom and loyalty (note how many uniforms are blue). People tend to be more productive in a blue room.

Green

The colour of growth, nature, and money. A calming colour also that's very pleasing to the senses. It is also the colour associated with envy, good luck, generosity and fertility.

Yellow

Cheerful yellow is the colour of the sun, associated with laughter, happiness and good times. It has the power to speed up our metabolism and bring out some creative thoughts. Some shades of yellow are associated with cowardice; but the more golden shades with the promise of better times.

Orange

It's the colour associated with funny times, happy and energetic days, warmth and organic products. It is also associated with ambition.

Purple

most royal colour that is associated with wealth, prosperity, rich sophistication. This colour stimulates the brain activity used in problem solving.

Brown

This colour is most associated with reliability, stability, and friendship and with things being natural or organic. In India it is the colour of mourning.

TASK:

- 1. Tell us your favourite colour(s). We will tell more about your personality, character traits, taste in fashion, etc.*
- 2. How do colours influence your choice when shopping, when choosing a girl for dating, when sitting for a job interview or for the school-leaving exam.*
- 3. What are the roles of colours in arts, business, sales marketing, advertising, on websites and computer science.*

GLOSSARY

absorb	pohlcovať, absorbovať
additive colours	aditívne farby RGB
align	zosúladiť, zostaviť, nastaviť, zarovnať
Amplitude modulation (AM) raster	amplitudovane modulovaný autotypický raster
basic colour properties	základné vlastnosti farieb
blur	rozostrenie
brightness	jasnosť, jas
colour mixing	miešanie farieb
colour reference value	hodnota farby, farebného odtieňa
darken	stmavenie
decrease contrast	znižiť, ubrať
diamond	kosoštvorcový
direct colours	priame
easy – severe (colour)	ľahký - ťažký
effects	efekty
emit	vyžarovať
entire spectrum	celé spektrum
filtres	filtre
focus	zostrenie
Frequency modulation (FM) raster	stochastický, frekvenčne modulovaný raster
increase contrast	zvýšiť, pridať
light –dark (colour)	svetlý - tmavý
lighten	zosvetlenie-
lightness	svetlosť
measuring	merací
monochromatic colours	jednofarebný, monochromatický
neutral colours	neutrálne farby
overall image editing	celkove úpravy obrazu
partial image editing	čiastkové úpravy obrazu
passive – active (colour)	pasívny -aktívny
perception	vnímanie
quote	citovať, uvádzať
round	kruhový
saturation	sýtosť
shade	odtieň
shapes of printing points	tvary tlačových bodov
solo colours (Pantone), single colours	monochromatické
spectral varied colours	spektrálne pestré farby
subtractive colours	subtraktívne CMY
transparent background	odstránenie pozadia
warm - cool	teplé – studené farby
zero brightness (black colour)	nulový jas (nulový jas)
zero saturation (white colour)	nulová sýtosť (biela farba)

SOURCES:

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http://en.wikipedia.org/wiki/Raster_image_processor

<http://www.color-wheel-pro.com/color-schemes.html>