

Week 4: Advanced Image Manipulation

DIGITAL ASSET DEVELOPMENT

Contents

- ⦿ Layers and blend modes
- ⦿ Image adjustments
- ⦿ Filtering methods

Photoshop Layers

- Much of the power of Photoshop comes from the use of **layers**
 - Enable the combination of many images into a single composition
 - **Adjustment layers** allow control of almost all aspects of an image
 - **Layer masks** allow effects to apply to certain areas of an image only
 - The effect of different layers depends on how those layers are blended

Blend Modes

- **Blend modes** allow pixels on adjacent layers to interact
- Modern versions have large number of blend modes
 - Photoshop CS6 includes 27
- The modes are grouped into a number of thematic sets
 - Understanding this helps in selecting suitable modes

Normal
Dissolve
Darken
Multiply
Color Burn
Linear Burn
Darken Color
Lighten
Screen
Color Dodge
Linear Dodge (Add)
Lighten Color
Overlay
Soft Light
Hard Light
Vivid Light
Linear Light
Pin Light
Hard Mix
Difference
Exclusion
Subtract
Divide
Hue
Saturation
Color
Luminosity

Darkening Blends

- ⦿ **Darken** and **Darker Colour** compare the two layers and use the darker pixel
- ⦿ **Multiply**, **Colour Burn** and **Linear Burn** use the top layer to darken the lower
 - A white pixel in the top layer leaves the lower layer unaffected
 - Dark pixels in the top layer turn pixels in the lower layer darker
- ⦿ Effect is to deepen shadows and make dark colours richer

Lightening Blends

- ⦿ The lightening modes are analogues of the darkening blend mode sets
- ⦿ **Lighten** and **Lighter Colour** compare the two layers and use the lighter pixel value
- ⦿ **Screen**, **Colour Dodge** and **Linear Dodge** similarly mimic their equivalents
 - Black pixels leave the lower layer unaltered
 - Paler pixels in the upper layer will brighten the underlying image

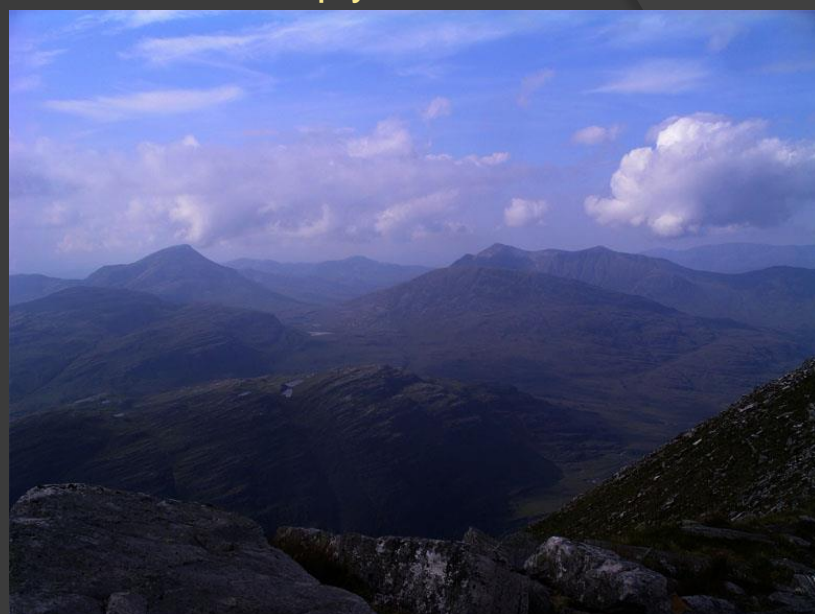
Contrast Adjustment Layers

- Many of the other blend modes are designed to adjust image contrast
- **Soft Light** mode effectively combines the effect of the **Multiply** and **Screen** modes
 - Mid-grey in the top layer leaves the lower layer unchanged
 - Light and dark areas of the upper layer brighten and deepen the pixels below
- **Hard Light** and **Vivid Light** give more extreme versions of this effect

original image



multiply blend mode



screen blend mode



soft light blend mode

Other Image Adjustments

- Blending layers is just one of many ways we can alter the character of an image
- We can also adjust brightness, contrast, colour balance, etc.
 - These are usually “point by point” operations
 - **Levels** or **Curves** (latter is usually best)
 - Some methods use the characteristics of the overall image (eg. **histogram equalisation**)
 - Other advanced techniques involve **filters**

Histogram Equalisation

- ◎ Best used when an image is either severely underlit or overlit
 - In other words, when detail is lost in shadow or through image saturation
 - Algorithm effectively **renormalises** image intensity and contrast
- ◎ Not always a suitable technique
 - Not useful where image has large uniform areas of little interest (eg. backdrops)

Effect of Equalisation

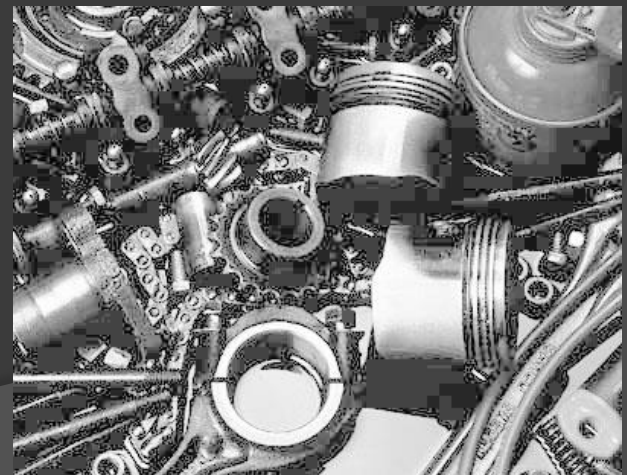
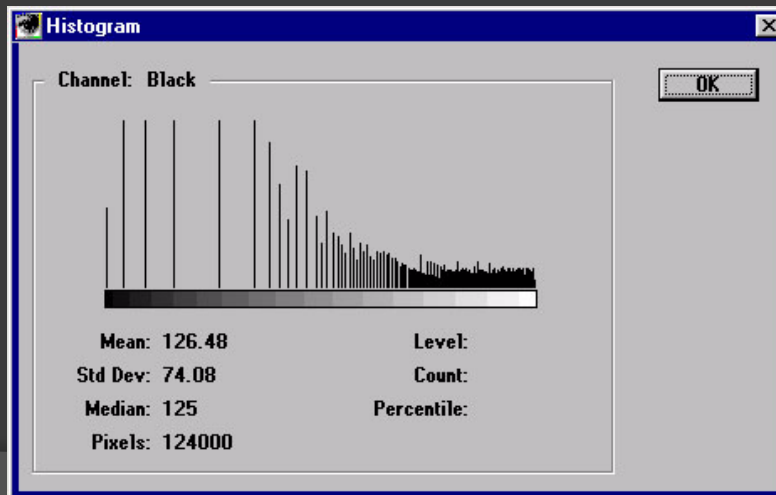
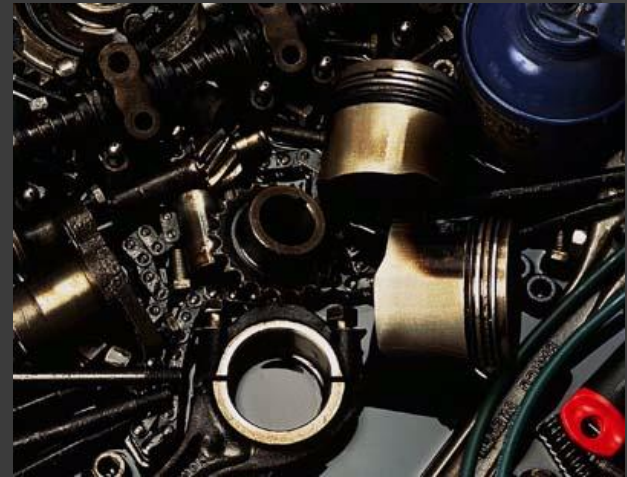
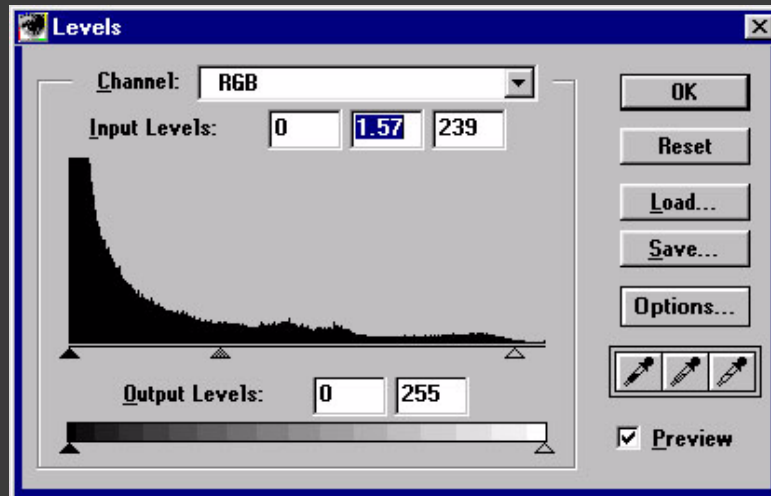


Image Filtering

- Applies generic effects to an entire image or selection
- Example: mosaic filter in Photoshop (pixellates an image)



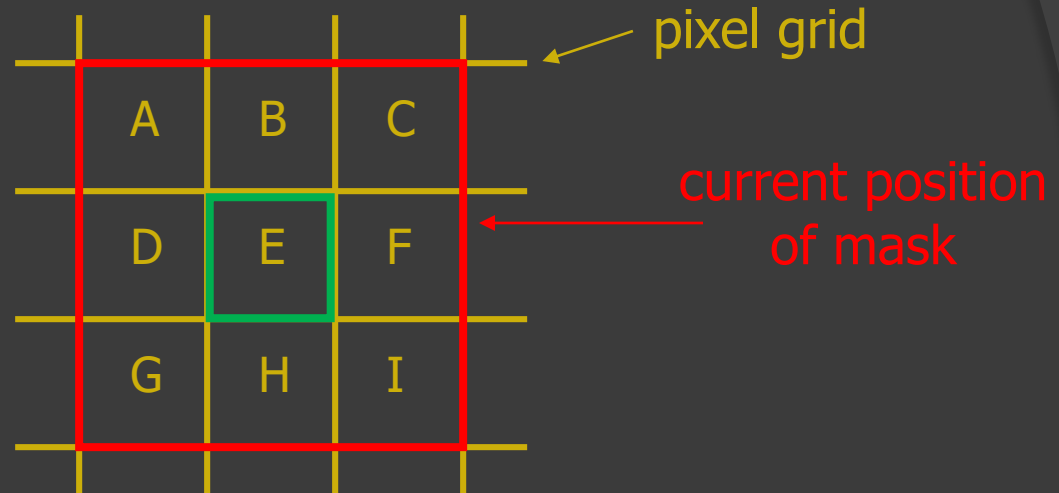
Kernel Filtering

- Many image filters are created using a kernel mask
- Define a mask of $n \times n$ pixels (eg. 3×3)
 - n usually an odd number
- Filter effect depends on:
 - Size of mask
 - Choice of numbers (called *coefficients*) associated with the mask

a_{11}	a_{12}	a_{13}
a_{21}	a_{22}	a_{23}
a_{31}	a_{32}	a_{33}

Applying the Filter

letters represent
pixel values at
each point



$$\begin{aligned} \text{new value of central pixel} = & a_{11} \times A + a_{12} \times B + a_{13} \times C \\ & + a_{21} \times D + a_{22} \times E + a_{23} \times F \\ & + a_{31} \times G + a_{32} \times H + a_{33} \times I \end{aligned}$$

repeat this process for every pixel in the image

Simple Example: Blurring

- Linear averaging filter
- Replace the central pixel value with the *average* value of pixels under mask
- This process will **smooth out** or **blur** the image

A	B	C
D	E	F
G	H	I

replace E with
 $A+B+C+D+E+F+G+H+I$
9

Results of Blurring

- General loss of detail in the scene
- Very useful for “noisy” images
- Larger masks cause greater blurring
- **Blur** and **Blur More** filters in Photoshop



Alternative Blurring Filter

- To create **motion blur**, average over one dimension only ($1 \times n$ mask)
- Larger value of n increases “speed”
- Useful for falling objects or moving vehicles



B becomes $\frac{A+B+C}{3}$

Median Filter

- ⦿ The **median filter** offers a smoothing filter which doesn't blur
- ⦿ Again, define $n \times n$ kernel mask
- ⦿ Instead of average, use the median (ie. middle value) of pixels under mask
- ⦿ Very good for removing “speckle” (ie. isolated noisy pixels)

Median Filter Example

150	150	120
180	0	140
180	150	140

pixel value has been
"lost", probably due
to *data dropout*

arrange in
numerical order



0, 120, 140, 140,
150,
150, 150, 180, 180



150	150	120
180	150	140
180	150	140

median value is
used in its place

Edge Detection

- We can use similar techniques to detect and enhance edges instead of blurring them
- Edge detection filters look for “gradients” in the image which correspond to edges



Sharpening Filter

- ◉ Add edge detection filter result to the original image
- ◉ Enhances the strength of the gradients (edges) while retaining overall image features



Custom Effects

- ⦿ We can design filters to simulate almost any effect
- ⦿ Packages like Photoshop have a wide range of filters plus third-party plugins
- ⦿ Can design your own kernel masks (choose “Other > Custom” on Filters menu)

Example: “Emboss” Filter

- Creates a third dimension by simulating shadows
- Define “sunlight” direction (here it is top-left → bottom-right)
- Apply shadows or highlights depending on edge “direction” (dark → light or light → dark)

