Starter – What is it?

0
= Black

1
= Yellow

0	0	0	1	1	1	0	0	0
0	0	1	1	1	1	1	0	0
0	1	1	0	1	0	1	1	0
1	1	1	0	1	0	1	1	1
1	1	1	1	1	1	1	1	1
1	1	0	1	1	1	0	1	1
1	1	0	0	1	0	0	1	1
0	1	1	0	0	0	1	1	0
0	0	1	1	1	1	1	0	0
0	0	0	1	1	1	0	0	0

Starter

0
= Black

1
= Yellow

0	0	0	1	1	1	0	0	0
0	0	1	1	1	1	1	0	0
0	1	1	0	1	0	1	1	0
1	1	1	0	1	0	1	1	1
1	1	1	1	1	1	1	1	1
1	1	0	1	1	1	0	1	1
1	1	0	0	1	0	0	1	1
0	1	1	0	0	0	1	1	0
0	0	1	1	1	1	1	0	0
0	0	0	1	1	1	0	0	0

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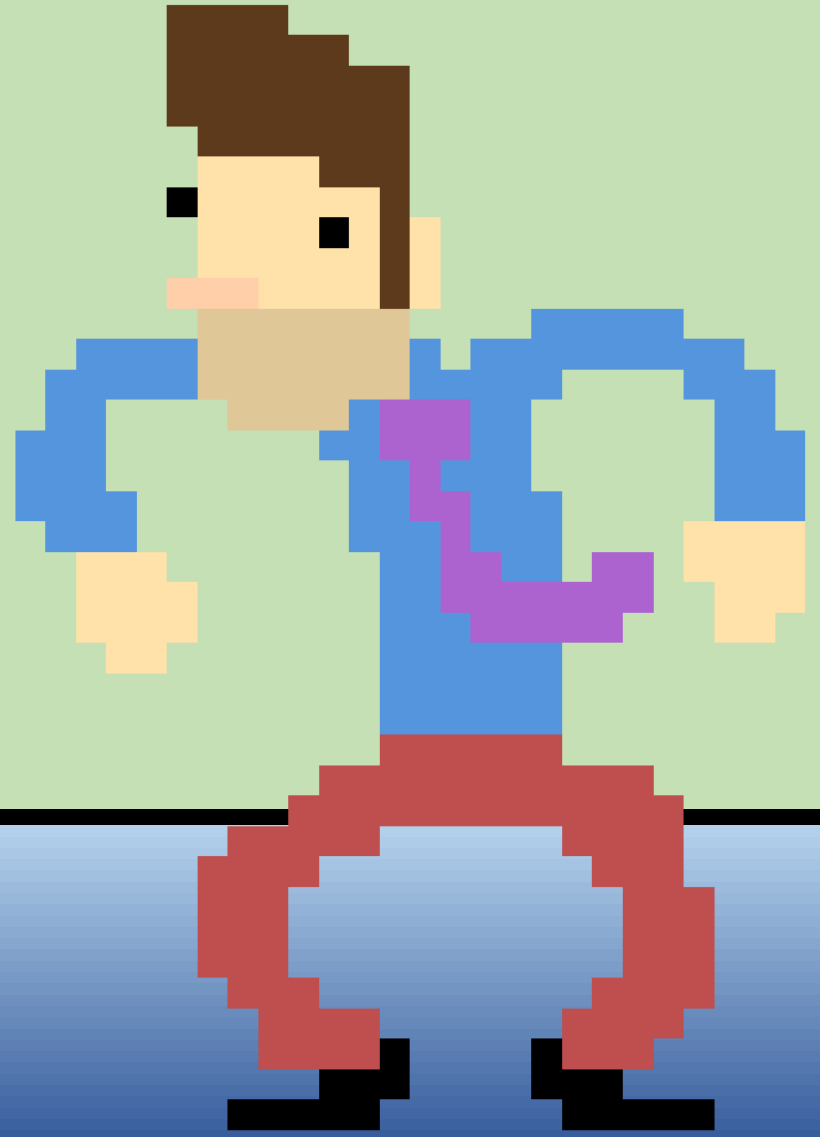
Cambridge Assessment International Education

Cambridge International School

Lesson 4
Images

Unit 1
Data Representation

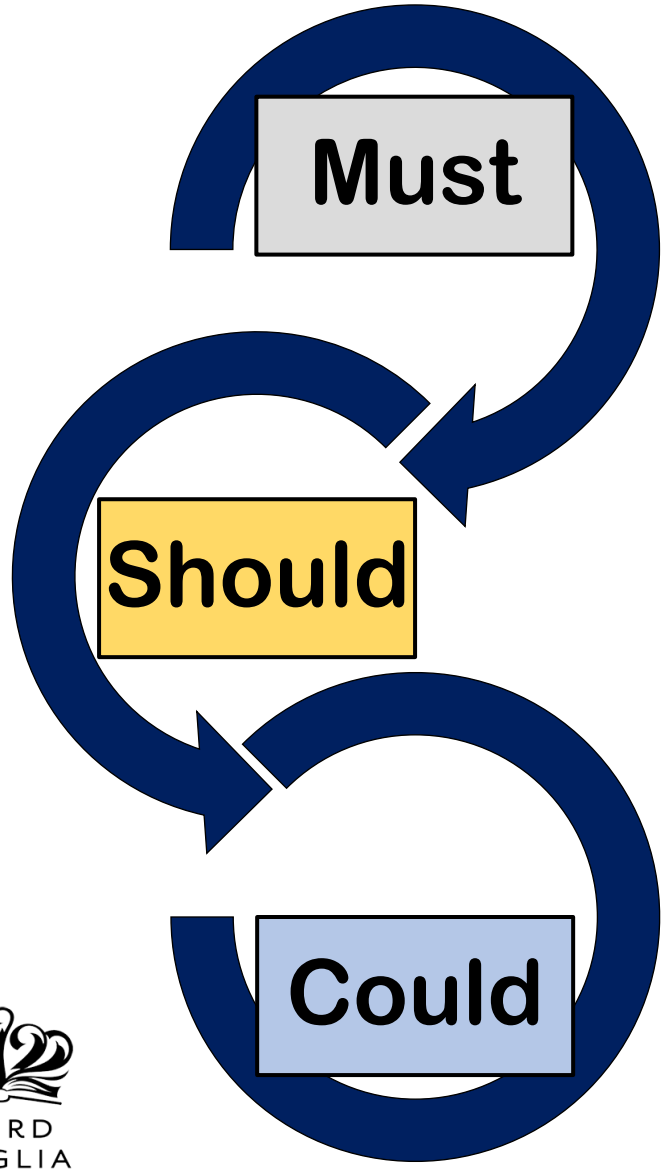


Mr. Teasdale

Today we are going to…

To understand how images are represented on a computer

Success Criteria



Explain how a bitmap graphic is made up of individual pixels

Understand that the number of bits per pixel determines the number of available colours for an image

Explain the relationship between file size and image resolution

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Representing text

- We have seen that positive integers can be represented in binary
- Negative numbers, and numbers with a decimal point, can also be represented as “pure” binary numbers
- But what about text?
- A different system is needed

Literacy Focus

- ❑ Bitmap
- ❑ Colour depth
- ❑ Metadata
- ❑ Pixel
- ❑ Resolution
- ❑ Vector

My Success Criteria

- ❑ Explain how a bitmap graphic is made up of individual pixels
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Image file types

Can you list some common image file extensions?

BMP

JPG

GIF

PNG

TIF

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- Vector

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Bitmap (or Raster) images

- Bitmap images are made up of PICture ELement or PIXELS
- A pixel is the smallest identifiable area of an image
- Each pixel is a single colour and is given a binary value which represents that colour e.g. 11000000 might equal Red
- A pixel's colour can be changed by changing this value

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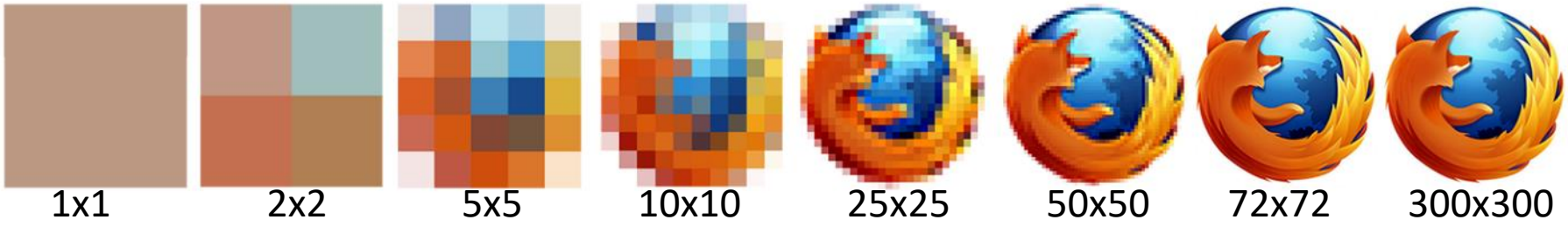
Image resolution

- Resolution is the concentration of pixels within a specific area
- The area is defined by the image width and height in pixels e.g. 3264x2448
- 72ppi (or dpi) = screen resolution
- 300ppi (or dpi) = print quality resolution



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Creating an Image

- Each Pixel is given a binary value
- Each value represents a different colour
- Using one bit per pixel allows only 2 values, 0 and 1

  1 = Black, 0 = White

0	0	0	0	1	0	0	0	0	0
0	0	0	1	1	0	0	0	0	0
0	0	1	1	1	0	1	0	0	0
0	1	1	1	1	0	1	1	0	0
1	1	1	1	1	0	1	1	1	0
0	0	0	0	1	0	1	0	0	0
1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	0
0	0	1	1	1	1	1	1	1	0
0	0	0	0	0	0	0	0	0	0

Literacy Focus

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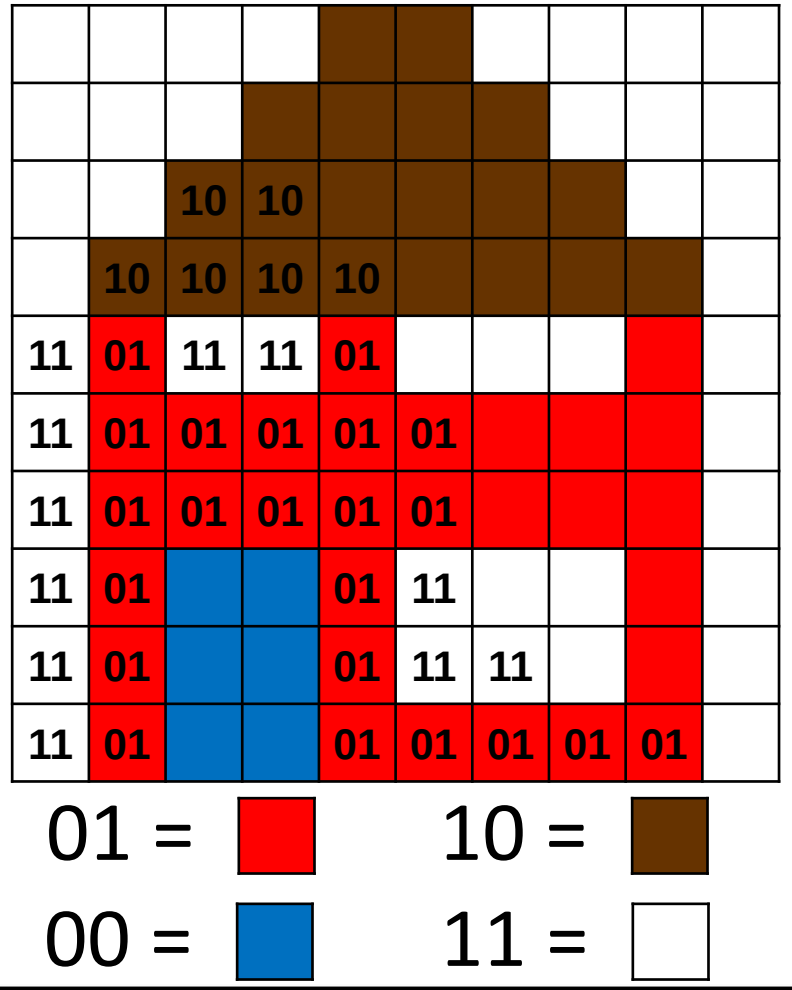
Increasing the number of colours

- More bits per pixel = more colour combinations
  - 1 bit = 2 Colours
  - **2 bits = 4 Colours**
  - 3 bits = 8 Colours
  - 4 bits = 16 Colours
- How many bits per pixel required for 256 colours?



Literacy Focus

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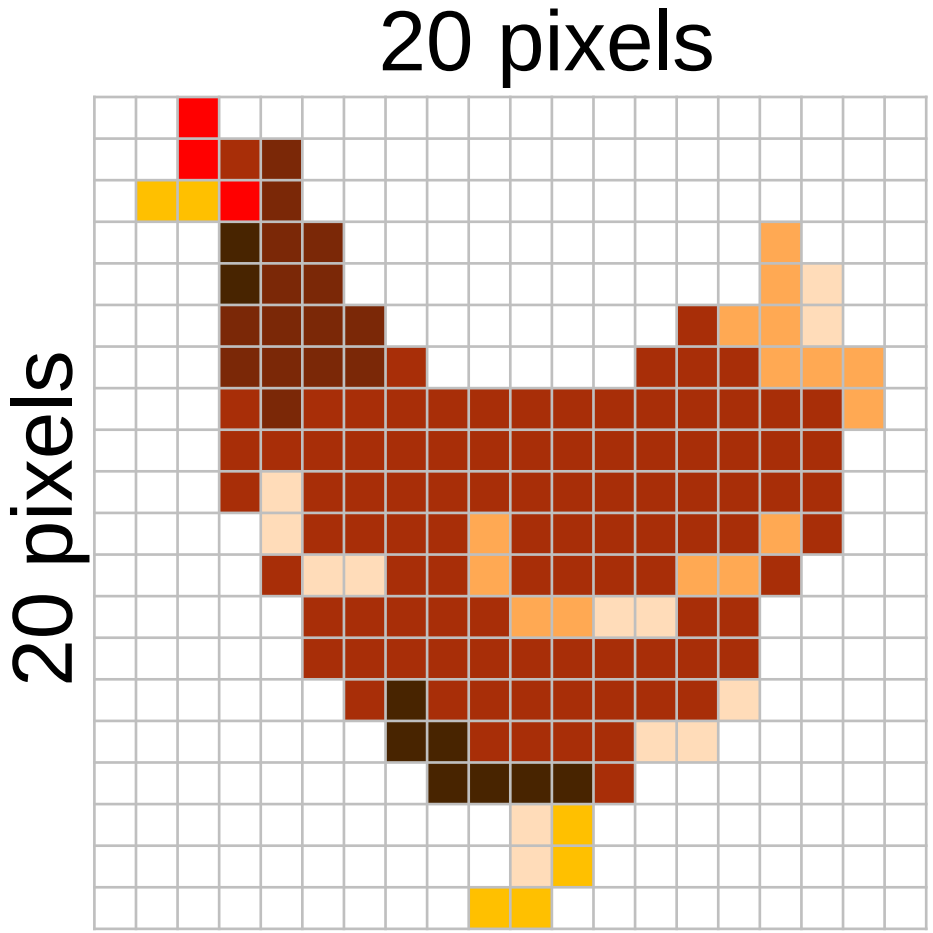
Colours and resolution vs File Size

- How does the number of colours affect file size?
- How does the size of the image affect file size?



8 colours

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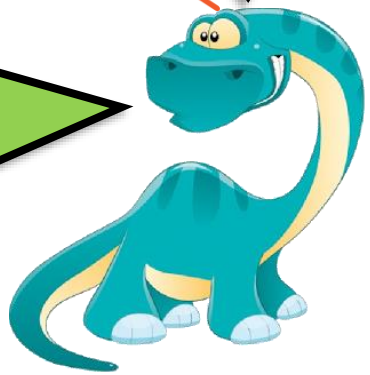
Task! Worksheet 4

- Now do **Tasks 1-4**

Need help?
Checkout the need help section

Challenge?
Checkout the want to go further section



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PBM monochrome images

- Store image dimensions
- Change ‘colours’ by changing binary values

```
10 10
0 0 0 0 1 0 0 0 0 0
0 0 0 1 1 0 0 0 0 0
0 0 1 1 1 0 1 0 0 0
0 1 1 1 1 0 1 1 0 0
1 1 1 1 1 0 1 1 1 0
0 0 0 0 1 0 1 0 0 0
1 1 1 1 1 1 1 1 1 1
0 1 1 1 1 1 1 1 1 0
0 0 1 1 1 1 1 1 1 0
0 0 0 0 0 0 0 0 0 0
```

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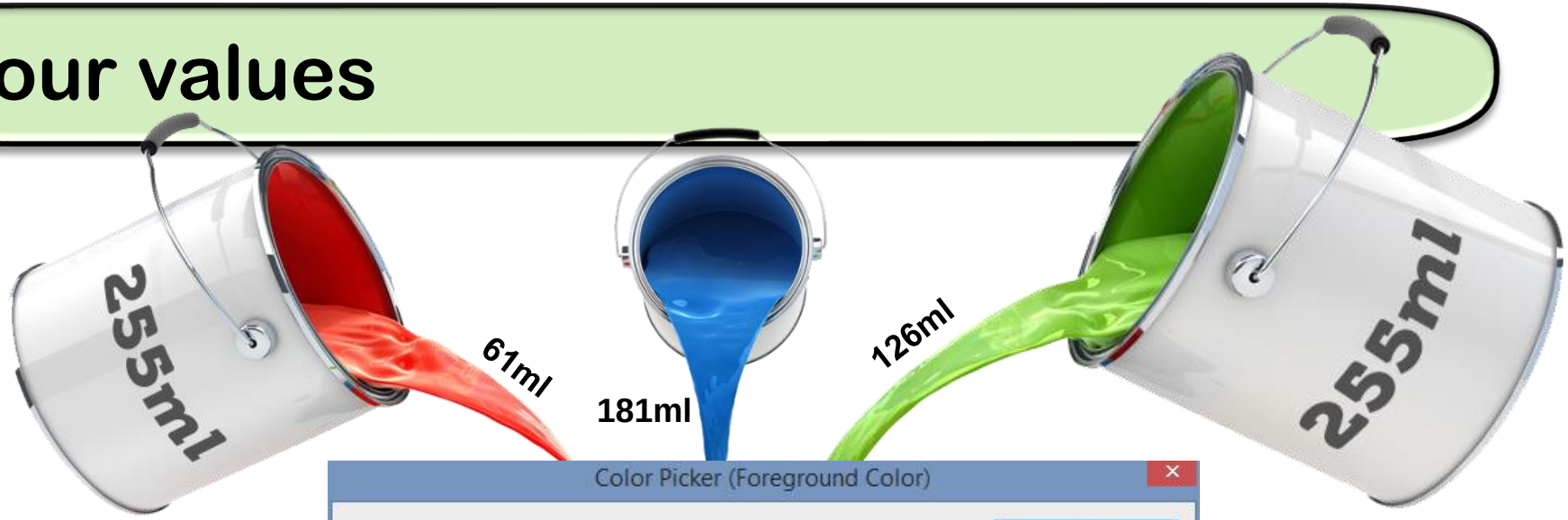
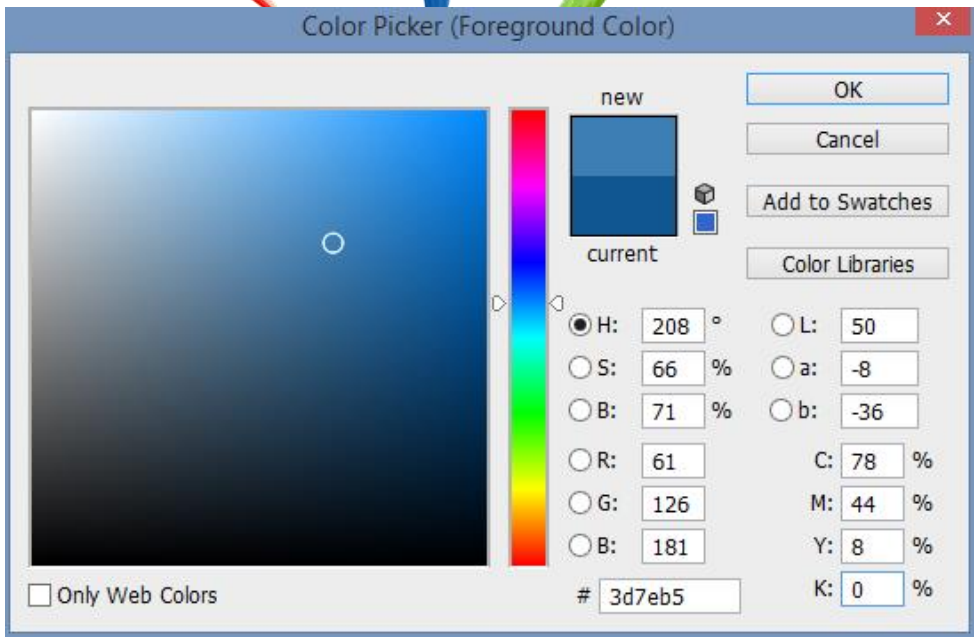
L/A: To understand how images are represented on a computer

Colour values





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Looking at colour codes

- Colour values of individual pixels are expressed as denary RGB values and in hexadecimal. Why not in binary in this instance?
- RGB (Red, Green and Blue) values range between 0-255. How many bits are required for 256 variations of each?
- How many bits altogether?
- In 32-bit colour what are the last 8 bits for?

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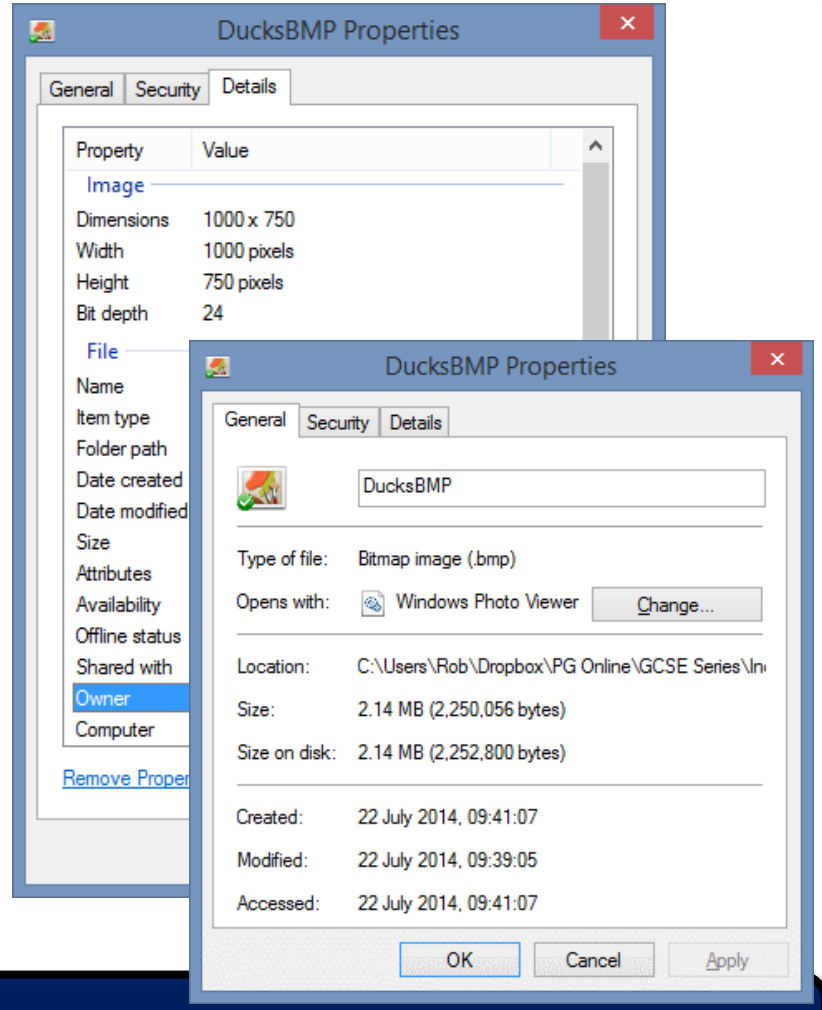
Why file sizes don't always add up

- DucksBMP: 1000 x 750 pixels
- 24 bit colour depth = 16m colours
- What is the file size in bytes and MB?
- Why is there a difference of 2,800 bytes?



Literacy Focus

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Image metadata

- Metadata is data about data
- It is information other than image data that is stored with a file
- This will include:
  - Colour depth in bits per pixel
  - Resolution (Height and width in pixels)
  - Date created
  - Author
- How big is the DucksJPG file? Why is this different?

Literacy Focus

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Image compression

- Reduces file size
- Two types:
  - Lossy Compression (JPG)
  - Lossless Compression (PNG)

- Any ideas?

Literacy Focus

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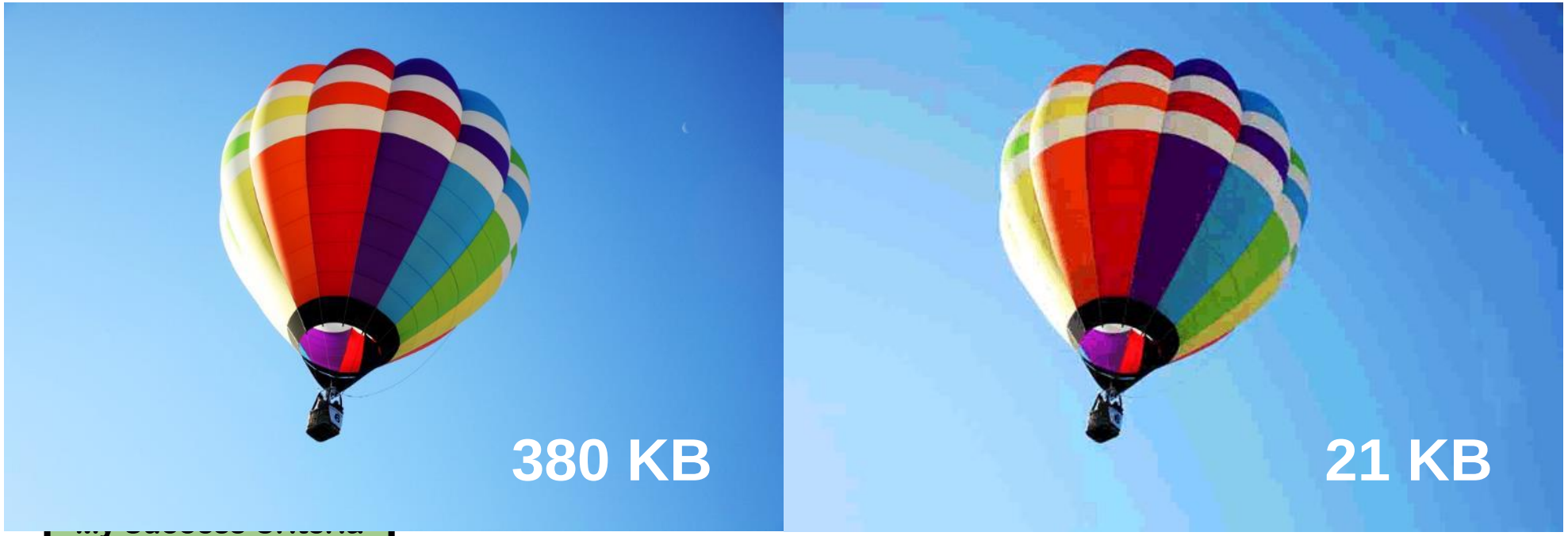
Lossy compression

- Removes data permanently
- Tries to reconstruct an image without the missing data
- Much smaller file sizes but some loss of quality



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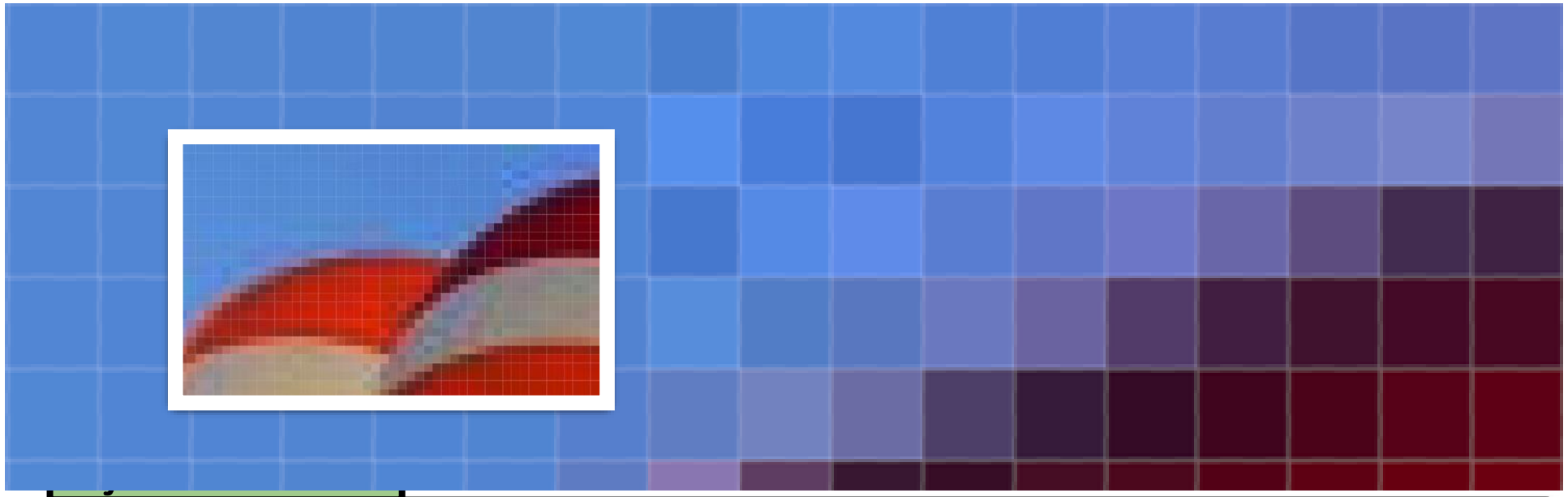
Lossless compression

- Finds areas of the same colour and records them as 15 blue pixels rather than blue pixel, blue pixel, blue pixel etc.
- 11011010,11011010,11011010,11011010 becomes **00000100-11011010**



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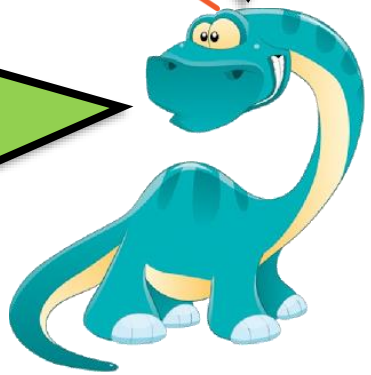
Task! Worksheet 4

- Now do **Task 5**

Need help?
Checkout the revision notes in your notebooks

Challenge?
Checkout the images extension task!



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L/A: To understand how images are represented on a computer

Comparison

- Copy the following table into your notebooks and complete the blanks

Compression Type	File Type	File Size	Image Quality

Literacy Focus

- ❑ Bitmap
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- ❑ Metadata
- ❑ Pixel
- ❑ Resolution
- ❑ Vector

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Checkpoint

✓How confident are you?

Must

Should

Could

SILVER

Explain how a bitmap graphic is made up of individual pixels

GOLD

Understand that the number of bits per pixel determines the number of available colours for an image

PLATINUM

Explain the relationship between file size and image resolution

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Cool down

1. Complete the skills ‘checklist’
2. Answer the confidence question

3. Reflect on your learning in your progress diaries
4. Review….. https://quizlet.com/520861395/learn

Literacy Focus

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Let's Review

Must

Should

Could

SILVER

Explain how a bitmap graphic is made up of individual pixels

GOLD

Understand that the number of bits per pixel determines the number of available colours for an image

PLATINUM

Explain the relationship between file size and image resolution

NORD ANGLIA EDUCATION

L/A: To understand how images are represented on a computer

Homework

Homework is in your notebooks, complete for **next** lesson!

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