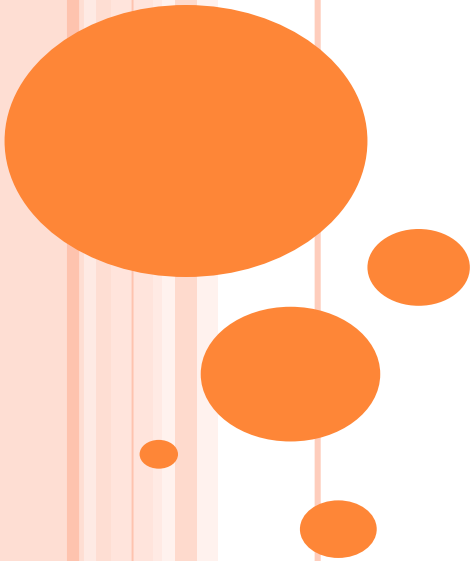


Color Attributes for Primitives

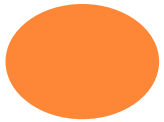
Color and Grayscale

- A basic attribute for all primitives is color.
- Various color options can be made available to a user, depending on the capabilities and design objectives of a particular system.
- Color options can be specified numerically or selected from menus or displayed slider scales.
- For a video monitor, these color codes are then converted to intensity-level settings for the electron beams.

RGB Color Components

- In a color raster system, the number of color choices available depends on the amount of storage provided per pixel in the frame buffer.

- Color information can be stored in the frame buffer in two ways:
  - We can store red, green, and blue (RGB) color codes directly in the frame buffer, or
  - We can put the color codes into a separate table and use the pixel locations to store index values referencing the color-table entries.



Direct storage scheme

- Whenever a particular color code is specified in an application program, that color information is placed in the frame buffer at the location of each component pixel in the output primitives to be displayed in that color.

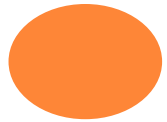
- A minimum number of colors can be provided in this scheme with 3 bits of storage per pixel, as shown in Table.

The eight RGB color codes for a 3-bit-per-pixel frame buffer

	Stored Color Values in Frame Buffer			
Color Code	RED	GREEN	BLUE	Displayed Color
0	0	0	0	Black
1	0	0	1	Blue
2	0	1	0	Green
3	0	1	1	Cyan
4	1	0	0	Red
5	1	0	1	Magenta
6	1	1	0	Yellow
7	1	1	1	White

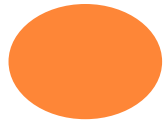
Direct storage scheme (Contd…)

- Each of the three bit positions is used to control the intensity level (either on or off, in this case) of the corresponding electron gun in an RGB monitor.
- The leftmost bit controls the red gun, the middle bit controls the green gun, and the rightmost bit controls the blue gun.
- Adding more bits per pixel to the frame buffer increases the number of color choices that we have.



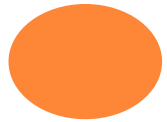
Direct storage scheme (Contd…)

- With 6 bits per pixel, 2 bits can be used for each gun.
- This allows four different intensity settings for each of the three color guns, and a total of 64 color options are available for each screen pixel.
- As more color options are provided, the storage required for the frame buffer also increases.
- With a resolution of 1024 × 1024, a full-color (24-bit per pixel) RGB system needs 3 MB of storage for the frame buffer.



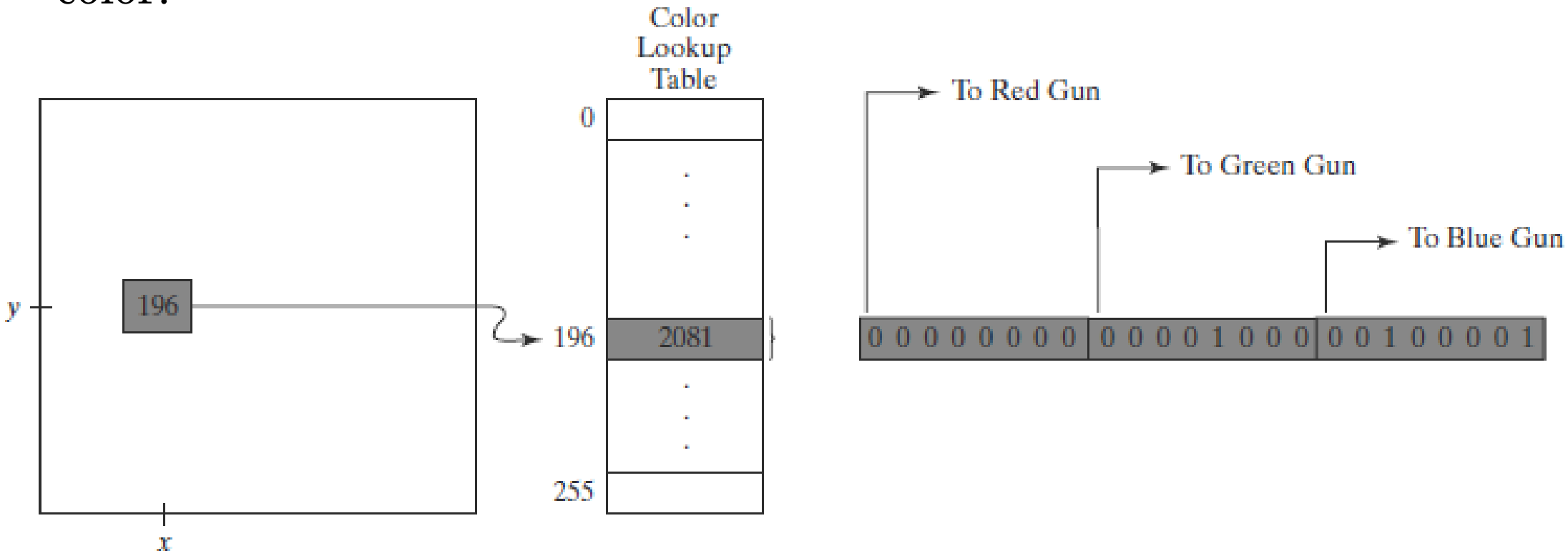
Color Table

- Color tables are an alternate means for providing extended color capabilities to a user without requiring large frame buffers.
- They are mostly referred to as **color lookup table** (or **color map** or **video lookup table**).
- Values stored in the frame buffer are now used as indices into the color table.



Color Table (Contd…)

- In this example, each pixel can reference any of the 256 table positions, and each entry in the table uses 24 bits to specify an RGB color.

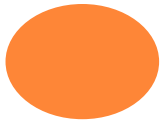


Color Table (Contd…)

- Systems employing this particular lookup table allow a user to select any 256 colors for simultaneous display from a palette of nearly 17 million colors.

- Compared to a full-color system, this scheme reduces the number of simultaneous colors that can be displayed, but it also reduces the frame-buffer storage requirement to 1 MB.

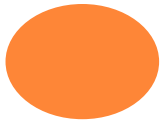
- A color table can be useful in a number of applications, and it can provide a “reasonable” number of simultaneous colors without requiring large frame buffers.



Color Table (Contd…)

- For most applications, 256 or 512 different colors are sufficient for a single picture.

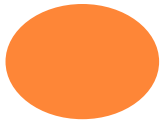
- Also, table entries can be changed at any time, allowing a user to be able to experiment easily with different color combinations in a design, scene, or graph without changing the attribute settings for the graphics data structure.



Color Table (Contd…)

- Some systems provide both capabilities for storing color information.

- A user can then elect either to use color tables or to store color codes directly in the frame buffer.

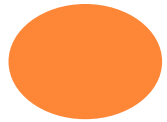


Grayscale

- Because color capabilities are now common in computer-graphics systems, we use RGB color functions to set shades of gray, or **grayscale,** in an application program.

- When an RGB color setting specifies an equal amount of red, green, and blue, the result is some shade of gray.

- Values close to 0 for the color components produce dark gray, and higher values near 1.0 produce light gray.



Thank You

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