Selected RQs:

The second approach of compressing images is that "Areas with similar colour can be modified to have the same colour. This has the effect of increasing the lengths of runs with identical intensities, making the first approach more effective."

But will this approach affect the quality of the compressed images since it considers areas with similar colour as ones with the same colour?

(submitted by Qian Zeng)

Selected RQs:

I've seen a picture of London that was supposedly 80 Giga-pixels. How would somebody take a picture that big or compress it or even have a storage device that could hold the image? I am able to look close up at things a mile or more away. How is it that they achieved such perfect scalability?

(submitted by Cameron)

Selected RQs:

In this Module we were reintroduced to the concept of RGB in digital images, and we understood the importance of RGB in relation to color distinction, but I was surprise to see that the module doesn't touch upon CMYK, the difference between RGB and CMYK and the pros and cons for both. As far as I know computer programs such as Photoshop, Illustrator, use other forms for identifying color schemes, why aren't these consider relevant to our class?

(submitted by Camilia)

Clicker Exercise

- which are vector representations?

A. tin toy & pig  C. tin toy & Seurat
B. pig & Seurat  D. just tin toy
Selected RQs:

Would the PDF module I'm reading use vector representation because the text is not pixelized when I zoom in and it also reacts to text searches?

(submitted by Leo Foon Ping, 2011W1 Student)

Clicker Exercise

Which are *bitmap* representations?

A. rabbit & needlepoint  
B. just needlepoint  
C. needlepoint & fonts  
D. just fonts

Vector Image Representation

*basic approach*

- describe each object of the image either as  
  - a sequence of dots (connected by lines), or  
  - a simple shape (e.g., rectangle, circle)  
- describe the colour (fill) of each closed object

*example*

Step on a vector image
### Vector Image Representation

**Example**

- the representation is a sequence of numbers
- it should be possible to unambiguously reconstruct the image from the representation

- Dimension of the grid (in cm)
- First dot
- Second dot
- Third dot
- Fourth dot
- Fifth dot

```
1, 2, 1, 2, 3, 3, 2, 2, 3, 3, 2, 2, 1
```

### Clicker Exercise

Which image is represented by the following sequence?

```
1, 2, 1, 2, 3, 3, 2, 1, 2, 2, 1
```

Options:

- A. 
- B. 
- C.

### Selected RQs:

In vector image representation, if you have more dots, does that necessarily mean the image will be clearer?

(submitted by Adrienne, 2011W1 Student)

### Exercise

Choose dots to represent the following images:

- How to choose the number of dots to use?
- Where to position the dots?
- What principles would you suggest in general, for selecting the dots to represent a picture?
Vector Image Representation

extensions of basic approach

- add width and colour of lines
- use curves instead of lines
- add shading to objects
- specify which objects overlay others
- extend to 3D
- ...

Bitmap or Vector Representation?

Do these devices produce vector (A) or bitmap (B) representations?

- cutting table
- photocopier
- pen plotter
Bitmap or Vector Representation?

**Do these devices produce vector or bitmap representations?**

- **inkjet printer:**
  "places extremely small droplets of ink onto paper to create an image [...] the dots are positioned very precisely with resolutions of up to 1440x720 dots per inch (dpi). The dots can have different colors"
  [Wikipedia]

- **laser printer**

Bitmap vs Vector Representation

**What properties distinguish these data types?**

- **size:** bitmap representations tend to be bigger than vector representations (even when compressed)

- **editing options:** (see notes)

- **generality:** bitmap representation can be applied to *any* type of image; this is not really true of vector representation

- **scalability**

Selected RQs:

**Why do scanners automatically save scanned texts in bitmap format and then the user has to convert to vector even though it should be obvious enough that the user wants a text in vector that the computer should just do it automatically?**

(Submitted by Sophie)

**Professional maps are published in vector format and would include a very large number of vector points; would at some limit, the data used to represent vector exceed the data used to represent bitmap?**

(Submitted by A Chu, 2011W1 Student)
Selected RQs:

In the lab, we created an image using vector representation by using JavaScript. Can we also use JavaScript to create bitmap represented images? If so, how hard would it be?

(submitted by Timothy)

Selected RQs:

Based on the readings, I get the idea that in order to add effects such as shading I need to convert a vector image into a bitmap image. Isn't there an algorithm to do such thing? It may be complicated but I would imagine it would be simpler than having to convert it first then edit then maybe converting back to vector once more.

(submitted by Timothy)

Learning Goals [for today]

you should be able to

describe why artists use computers to create art, grounded in the motivations and works of computer artists (e.g., Molnar, Noll, Truckenbrod, and Cohen)

connect key advances in computing – including display technology, price and accessibility, and software – to changes in computer art

Possible Questions for Art Critique*

• description: What do I see?
• medium: What tools, materials, or processes did the artist use?
• form: What elements did the artist choose and how did the maker organize the elements?
• interpretation: What is the artwork about?
• criteria: What criteria do I think are most appropriate for judging the artwork?
• evidence: What evidence inside or outside the artwork relates to each criterion?
• judgment: Based on the criteria and evidence, what is my judgment about the quality of the artwork?

* based roughly on Terry Barrett's Criticizing Art: Understanding the Contemporary (1994)
<table>
<thead>
<tr>
<th>Vera Molnar</th>
<th>A. Michael Noll</th>
<th>Joan Truckenbrod</th>
<th>Harold Cohen / AARON</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Jacquard loom wove patterns according to instructions encoded in punched cards (early 1800s)

General-purpose computing devices
– Analytical Engines—envisioned by Charles Babbage, Ada Lovelace (mid 1800s)

First electronic computer, the ENIAC, completed in 1946, motivated by goals of mathematical calculations and military research

“[The Analytical Engine] might act upon other things besides number, were objects found whose mutual fundamental relations could be expressed by those of the abstract science of operations [...] the engine might compose elaborate and scientific pieces of music of any degree of complexity or extent” – Ada Lovelace

“The distinctive characteristic of the Analytical Engine [...] is the introduction into it of the principle which Jacquard devised for regulating, by means of punched cards, the most complicated patterns in the fabrication of brocaded stuffs [...] We may say most aptly that the Analytical Engine weaves algebraical patterns just as the Jacquard-loom weaves flowers and leaves.” – Ada Lovelace

Early 1950s

computers were used primarily for mathematical calculation
IBM concludes that five computers are sufficient for U.S. market
little access to computers for artists
Mid 1950s – Early 1970s

computer-driven pen plotters
vector graphics
incapable of filling areas
“technical”-looking

images were produced using line-drawing algorithms
access, programming expertise needed
works could not be photo-realistic

Mid 1950s – Early 1970s

much interest at Bell Labs, a research lab in New Jersey (USA)

first computer graphics group at Boeing
(why Boeing – an airplane manufacturer?)

early examples of computer animation

A. Michael Noll’s Experiments

researcher (engineer, computer scientist, artist) at Bell Labs

used computers to explore roles of randomness and chance in “laws of aesthetics”

used random number generators to add variation to drawings

landmark studies compared peoples’ preferences for computer generated “Mondrian-like” drawings with Mondrian original